



REGULATORY COMPLIANCE TEST REPORT

**FCC CFR 47 Part 15 Subpart C 15.247 (FHSS),
ISED RSS-247 Issue 4 July 2025**

Report No.: HAYW01-U6 Rev A

Company: Hayward Industries, Inc.

Model Name: G115000318

REGULATORY COMPLIANCE TEST REPORT

Company Name: Hayward Industries, Inc.

Model Name: G115000318

To: FCC CFR 47 Part 15 Subpart C 15.247 (FHSS),
ISED RSS-247 Issue 4 July 2025

Test Report Serial No.: HAYW01-U6 Rev A

This report supersedes: NONE

Applicant: Hayward Industries, Inc.
1 Hayward Industrial Dr
Clemmons, NC 27012
United States of America

Issue Date: 31st July 2026

This Test Report is Issued Under the Authority of:

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MiCOM Labs is an ISO 17025 Accredited Testing Laboratory

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1. ACCREDITATION, LISTINGS & RECOGNITION

1.1. TESTING ACCREDITATION

MiCOM Labs, Inc. is an accredited Electrical testing laboratory per the international standard ISO/IEC 17025:2017. The company is accredited by the American Association for Laboratory Accreditation (A2LA) www.a2la.org test laboratory number 2381.01. MiCOM Labs test schedule is available at the following URL; <http://www.a2la.org/scopepdf/2381-01.pdf>



1.2. RECOGNITION

MiCOM Labs, Inc is widely recognized for its wireless testing and certification capabilities. In addition to being recognized for Testing and Certification under Phase 2 Mutual Recognition Agreements (MRA) with Canada, Europe, United Kingdom and Japan, our international recognition includes Conformity Assessment Body (CAB) designation status under agreements with Asia Pacific (APEC) MRA Phase 1 countries giving acceptance of MiCOM Labs test reports. MiCOM Labs test reports are accepted globally.

Country	Recognition Body	Status	MRA Phase	Identification No.
USA	Federal Communications Commission (FCC)	TCB	-	US0159 Test Firm Designation#: US1084
Canada	Industry Canada (ISED)	FCB	APEC MRA 2	US0159 ISED#: 4143A
Japan	MIC (Ministry of Internal Affairs and Communication)	CAB	Japan MRA 2	RCB 210
	Japan Approvals Institute for Telecommunication Equipment (JATE)			
	VCCI			
Europe	European Commission	NB	EU MRA 2	NB 2280
United Kingdom	Department for Business, Energy & Industrial Strategy (BEIS)	AB	UK MRA 2	AB 2280
Indonesia	Minister of Communication and Digital Education <i>Keputusan Menteri Komunikasi Dan Digital</i>	Number 13 List of Overseas Test Labs	--	Lab n°50/2025 of Decree n°13
Mexico	Instituto Federal de Telecomunicaciones (IFT)	CAB	Mexico MRA 1	US0159
Australia	Australian Communications and Media Authority (ACMA)	CAB	APEC MRA 1	US0159
Hong Kong	Office of the Telecommunication Authority (OFTA)			
Korea	Ministry of Information and Communication Radio Research Laboratory (RRL)			
Singapore	Infocomm Development Authority (IDA)			
Taiwan	National Communications Commission (NCC)			
	Bureau of Standards, Metrology and Inspection (BSMI)			
Vietnam	Ministry of Communication (MIC)			

TCB – Telecommunications Certification Bodies (TCB)

FCB – Foreign Certification Body

CAB – Conformity Assessment Body

NB – Notified Body

AB – Approved Body

MRA – Mutual Recognition Agreement

MRA Phase I - recognition for product testing

MRA Phase II – recognition for both product testing and certification

1.3. PRODUCT CERTIFICATION

MiCOM Labs, Inc. is an accredited Product Certification Body per the international standard ISO/IEC 17065:2012. The company is accredited by the American Association for Laboratory Accreditation (A2LA) www.a2la.org test laboratory number 2381.02. MiCOM Labs test schedule is available at the following URL; <http://www.a2la.org/scopepdf/2381-02.pdf>



United States of America – Telecommunication Certification Body (TCB)
Industry Canada – Certification Body, CAB Identifier – US0159
Europe – Notified Body (NB), NB Identifier - 2280
UK – Approved Body (AB), AB Identifier - 2280
Japan – Recognized Certification Body (RCB), RCB Identifier - 210

2. DOCUMENT HISTORY

Document History		
Revision	Date	Comments
Draft	20th July 2026	Draft report for client review.
Rev A	31st July 2026	Initial Release

In the above table the latest report revision will replace all earlier versions.

3. TEST RESULT CERTIFICATE

Manufacturer: Hayward Industries, Inc. 1 Hayward Industrial Dr Clemmons NC 27012 United States of America	Tested By: MiCOM Labs, Inc. 575 Boulder Court Pleasanton California 94566 USA
Model: G115000318	Telephone: +1 925 462 0304 Fax: +1 925 462 0306
Type Of Equipment: RF Radio Module	
S/N's: PCB #11; PCB #13	
Test Date(s): 29 th June – 13 th July 2026	Website: www.micomlabs.com

STANDARD(S)	TEST RESULTS
FCC CFR 47 Part 15 Subpart C (15.247 FHSS) , ISED RSS-247 Issue 4 July 2025	EQUIPMENT COMPLIES

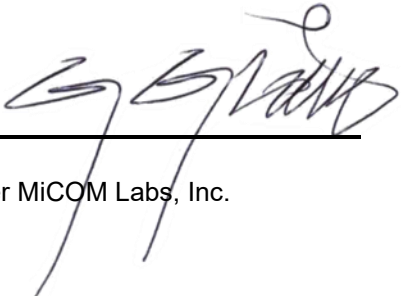
MiCOM Labs, Inc. tested the equipment mentioned in accordance with the requirements set forth in the above standards. Test results indicate that the equipment tested is capable of demonstrating compliance with the requirements as documented within this report.

Notes:

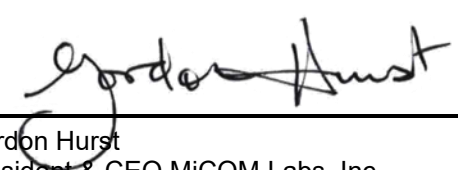
1. This document reports conditions under which testing was conducted and the results of testing performed.
2. Details of test methods used have been recorded and kept on file by the laboratory.
3. Test results apply only to the item(s) tested.

Approved & Released for MiCOM Labs, Inc. by:





Graeme Grieve
Quality Manager MiCOM Labs, Inc.



Gordon Hurst
President & CEO MiCOM Labs, Inc.

4. REFERENCES AND MEASUREMENT UNCERTAINTY

4.1. Normative References

REF.	PUBLICATION	YEAR	TITLE
I	FCC 47 CFR Part 15.247	Apr 2020	Radio Frequency Devices; Subpart C – Intentional Radiators
II	RSS-247 Issue 4	July 2025	RSS-247 — Digital Transmission Systems, Frequency Hopping Systems and Licence-Exempt Local Area Network Devices in 902-928 MHz, 2400-2483.5 MHz, 5150-5350 MHz, and 5470-5895 MHz bands.
III	ICES-003	Issue 7; Oct 2020	Information Technology Equipment (Including Digital Apparatus)
IV	KDB 662911 D01, D02, D03	D01 Oct 2013, D02 Oct 2011, D03 Oct 2020	Guidance for measurement of output emission of devices that employ single transmitter with multiple outputs or systems with multiple transmitters operating simultaneously in the same frequency band. 662911 D01 Multiple Transmitter Output v02r01, 662911 D02 MIMO with Cross Polarized Antenna v01, 662911 D03 MIMO Antenna Gain Measurement v01, OET 13TR1003 Directional Gain of 802 11 MIMO with CDD 04 05 2013
V	KDB 558074 D01 v05r02	Apr 2019	Guidance for Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid System Devices operating under section 15.247 of the FCC Rules.
VI	A2LA R105	24th February 2025	Requirements When Making Reference to A2LA Accreditation Status.
VII	ANSI C63.10-2020+Amendment 1 C63.10a-2024 + Errata to C63.10a-2024	2024	American National Standard for Testing Unlicensed Wireless Devices
VIII	ANSI C63.4	2014 + C63.4a-2017 Amendment	American National Standards for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
IX	ETSI TR 100 028	2001-12	Parts 1 and 2 Electromagnetic compatibility and Radio Spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics
X	UKAS M3003	Edition 6 March 2024	The Expression of Uncertainty and Confidence in Measurements
XI	RSS-Gen	Issue 5 April 2018 + Amendment 1 (March 2019) + Amendment 2 (February 2021)	General Requirements for Compliance of Radio Apparatus.
XII	FCC 47 CFR Part 2.1033	Feb 2023	FCC requirements and rules regarding photographs and test setup diagrams.
XIII	UKAS LAB 12	Edition 5 December 2025	The Expression of Uncertainty in Testing

4.2. Test and Uncertainty Procedure

Conducted and radiated emission measurements were conducted in accordance with American National Standards Institute ANSI C63.4, listed in the Normative References section of this report.

Measurement uncertainty figures are calculated in accordance with ETSI TR 100 028 Parts 1 and 2.

Measurement uncertainties stated are based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95 % in accordance with UKAS document M 3003 listed in the Normative References section of this report.

5. PRODUCT DETAILS AND TEST CONFIGURATIONS

5.1. Technical Details

Details	Description
Purpose:	Test of the Hayward Industries, Inc. G115000318 to FCC CFR 47 Part 15 Subpart C 15.247 (FHSS) 15.247 (FHSS). Radio Frequency Devices; Subpart C – Intentional Radiators
Applicant:	Hayward Industries, Inc. 1 Hayward Industrial Dr Clemmons NC 27012 United States of America
Manufacturer:	Hayward Industries, Inc.
Laboratory performing the tests:	MiCOM Labs, Inc. 575 Boulder Court Pleasanton California 94566 USA
Test report reference number:	HAYW01-U6 Rev A
Date EUT received:	4 th June 2026
Standard(s) applied:	FCC CFR 47 Part 15 Subpart C 15.247 (FHSS) , ISSED RSS-247
Dates of test (from - to):	29 th June – 13 th July 2026
No of Units Tested:	2
Product Family Name:	RNW-BT926
Model(s):	G115000318
Location for use:	Both indoor and outdoor
Declared Frequency Range(s):	902 - 928 MHz;
Type of Modulation:	2-GFSK
EUT Modes of Operation:	902 - 928 MHz: FHSS
Declared Nominal Output Power (dBm):	+14 dBm
Transmit/Receive Operation:	1
Rated Input Voltage and Current:	1.8V to 3.8V (3.3V nominal) / 150 mA max.
Operating Temperature Range:	-20°C to +60°C (Client Declared)
ITU Emission Designator:	93K8F1D
Equipment Dimensions:	1.535" x 2.520" x 0.275".
Weight:	0.56oz (16.0g)
Hardware Rev:	A-1
Software Rev:	7.10.01.24

5.2. Scope Of Test Program

Hayward Industries, Inc. G115000318

The scope of the test program was to test the Hayward Industries, Inc. G115000318 Frequency Hopping Spread Spectrum (FHSS) configuration in the frequency ranges 902 - 928 MHz; for compliance against the following specification:

FCC CFR 47 Part 15 Subpart C 15.247 (FHSS) 15.247 (FHSS)

Radio Frequency Devices; Subpart C – Intentional Radiators

RSS-247 Issue 4 July 2025

RSS-247 — Digital Transmission Systems, Frequency Hopping Systems and License-Exempt Local Area Network Devices in 902-928 MHz, 2400-2483.5 MHz, 5150-5350 MHz, and 5470-5895 MHz bands.

5.3. Equipment Model(s) and Serial Number(s)

Model	Serial Number
G115000318	PCB #11
G115000318	PCB #13

5.4. Cabling and I/O Ports

Port Type	Max Cable Length	# of Ports	Shielded	Conn Type	Data Type	Bit Rate	Environment
UART JTAG	0.2m	2	Yes	10 pin 127 mm	UART JTAG	UART = 115.2kbps JTAG = 2.5-10Mbps (variable)	Indoor/Outdoor
U.FL	<3m	1	Yes	RF	Analog	N/A	Indoor/Outdoor

5.5. Antenna Details

Type	Manufacturer	Model	Family	Gain (dBi)	BF Gain	Dir BW	X-Pol	Frequency Band (MHz)
External	AVX Kyocera	X9000984-4GDSMB	Dipole	2.2	-	360	-	900-928
Integral	Ignion	NN02-224	Chip	2.1	-	360	-	900-928

BF Gain - Beamforming Gain
Dir BW - Directional BeamWidth
X-Pol - Cross Polarization

5.6. Test Configurations

Results for the following configurations are provided in this report:

Operational Mode(s) (802.11a/b/g/n/ac)	Data Rate with Highest Power MBit/s	Channel Frequency (MHz)		
		Low	Mid	High
902 - 928 MHz				
OM	50 Kbps	902.2	915	927.7

5.7. Operational Modes

Operating Mode(s)	Operating Mode Description
902 – 928 MHz FHSS	Frequency Hopping Spread Spectrum

5.8. Equipment Modifications

The following modifications were required to bring the equipment into compliance:

1. NONE

5.9. Deviations from the Test Standard

The following deviations from the test standard were required in order to complete the test program:

1. NONE

6. TEST SUMMARY

List of Measurements

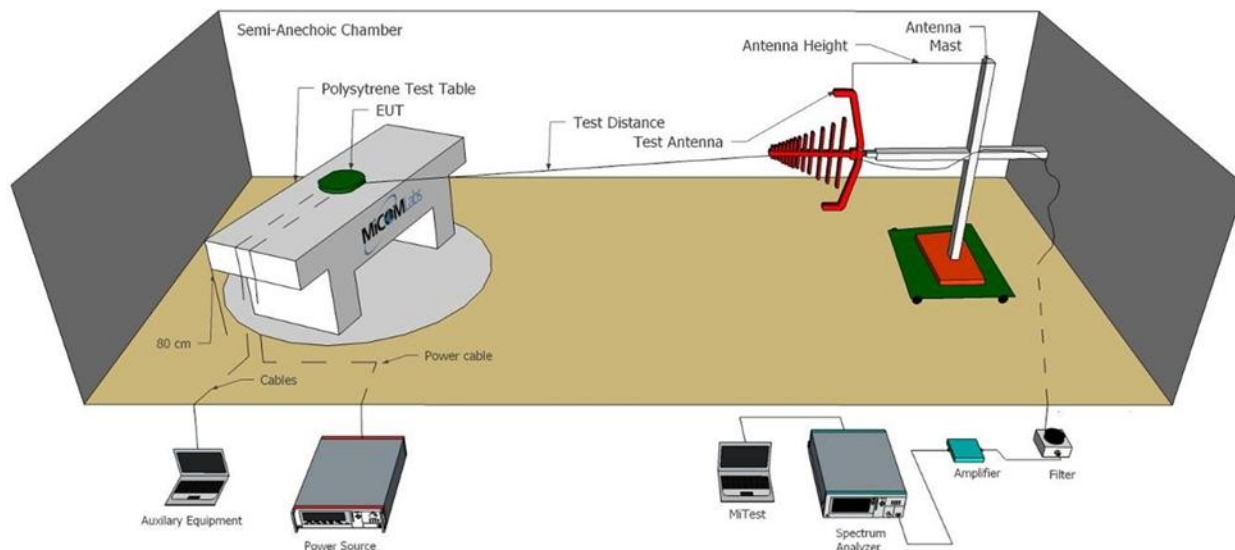
Test Header	Result	Data Link
20 dB & 99% Bandwidth	Complies	View Data
Frequency Hopping Tests	Complies	-
Number of Hopping Channels	Complies	View Data
Channel Separation	Complies	View Data
Dwell Time	Complies	View Data
Channel Occupancy	Complies	View Data
Output Power	Complies	View Data
Emissions	Complies	-
(1) Conducted Emissions	Complies	-
(i) Conducted Unwanted Spurious Emissions	Complies	View Data
(ii) Conducted Band-Edge Emissions	Complies	View Data
(2) Radiated Emissions	Complies	-
(i) TX Spurious & Restricted Band Emissions	Complies	View Data
(3) Digital Emissions (0.03 - 1 GHz)	Complies	See MiCOM Labs Test Report HAWY01-U2 FCC 15B ICES-003
(4) AC Wireline Emissions	Complies	See MiCOM Labs Test Report HAWY01-U2 FCC 15B ICES-003

7. TEST EQUIPMENT CONFIGURATION(S)

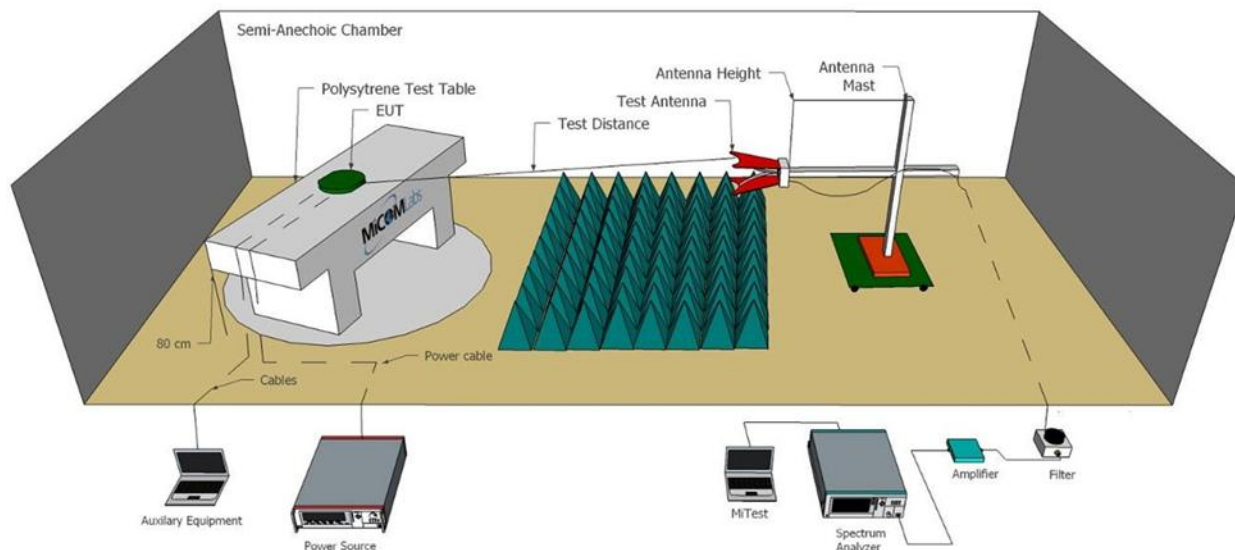
7.1.1. Radiated Test Setup

Test setup diagrams for Radiated Emissions below and above 1 GHz.

Radiated Emissions Below 1GHz Test Setup



Radiated Emissions Above 1GHz Test Setup



Test Equipment Utilized

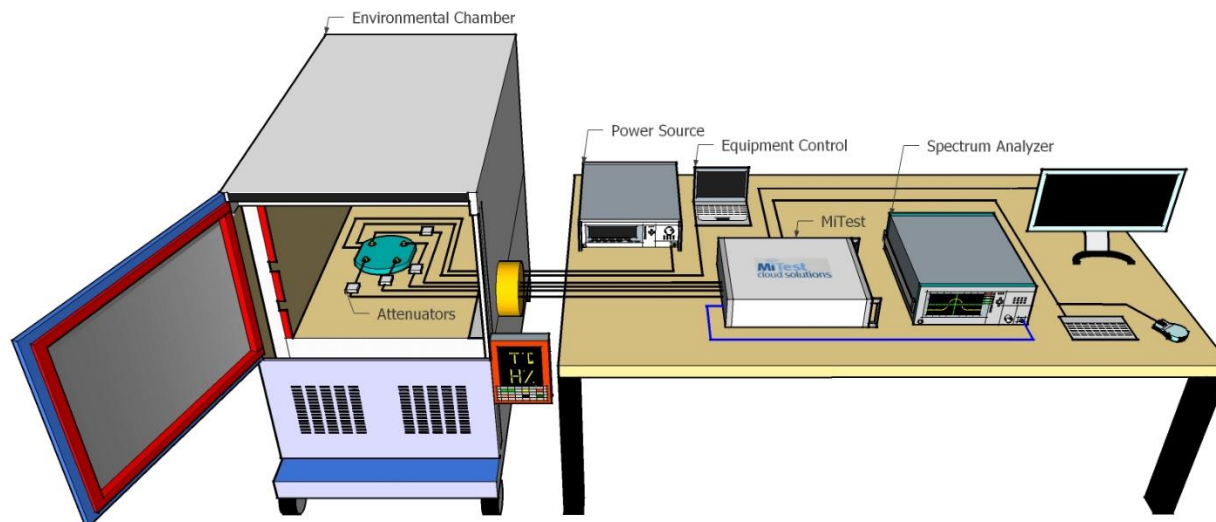
A full system calibration was performed on the test station and any resulting system losses (or gains) were taken into account in the production of all final measurement data.

Asset#	Description	Manufacturer	Model#	Serial#	Calibration Due Date
170	Video System Controller for Semi Anechoic Chamber	Panasonic	WV-CU101	04R08507	Not Required
266	10 Hz to 50GHz MXA Signal Analyzer	Keysight	N9020B	MY60110791	17 Jun 2027
298	3M Radiated Emissions Chamber Maintenance Check	MiCOM	3M Chamber	298	22 Aug 2026
330	Variac 0-280 Vac	Staco Energy Co	3PN1020B	0546	Cal when used
338	Sunol 30 to 3000 MHz Antenna	Sunol	JB3	A052907	5 Dec 2026
341	900 MHz Notch Filter	EWT	EWT-14-0199	H1	13 Sep 2026
346	1.6 TO 10GHz High Pass Filter	EWT	EWT-57-0112	H1	25 Aug 2026
382	Tunable Notch Filter	Wainwright Instruments GmbH	WRCT800/960-0.2/40-8EEK	64	Cal when used
397	Amp 10 - 2500MHz	MiCOM Labs	Amp 10 - 2500 MHz	NA	18 Aug 2026
399	ETS 1-18 GHz Horn Antenna	ETS	3117	00154575	7 Dec 2026
406	Amplifier for Radiated Emissions	MiCOM Labs	40dB 1 to 18GHz Amp	0406	18 Aug 2026
410	Desktop Computer	Dell	Inspiron 620	WS38	Not Required
411	Mast/Turntable Controller	Sunol Sciences	SC98V	060199-1D	Not Required
412	USB to GPIB Interface	National Instruments	GPIB-USB HS	11B8DC2	Not Required
413	Mast Controller	Sunol Science	TWR95-4	030801-3	Not Required
415	Turntable Controller	Sunol Sciences	Turntable Controller	None	Not Required
416	Gigabit ethernet filter	ETS-Lingren	Gigafoil 260366	None	Not Required
447	MiTest Rad Emissions Test Software	MiCOM	Rad Emissions Test Software Version 1.0	447	Not Required
462	Schwarzbeck cable from Antenna to Amplifier.	Schwarzbeck	AK 9513	462	18 Aug 2026
463	Schwarzbeck cable from Amplifier to Bulkhead.	Schwarzbeck	AK 9513	463	18 Aug 2026
464	Schwarzbeck cable from Bulkhead to Receiver	Schwarzbeck	AK 9513	464	18 Aug 2026

465	Low Pass Filter DC-1000 MHz	Mini-Circuits	NLP-1200+	VUU01901402	18 Aug 2026
480	Cable - Bulkhead to Amp	SRC Haverhill	157-3050360	480	18 Aug 2026
481	Cable - Bulkhead to Receiver	SRC Haverhill	151-3050787	481	18 Aug 2026
510	Barometer/Thermometer	Digi Sense	68000-49	170871375	4 Jan 2027
554	Precision SMA Cable	Fairview Microwave	SCE18060 101-400CM	554	18 Aug 2026
555	Rhode & Schwarz Receiver (Firmware Version : 3.10 SP1)	Rhode & Schwarz	ESW 44	101893	14 Aug 2026
87	Uninterruptible Power Supply	Falcon Electric	ED2000-1/2LC	F3471 02/01	Cal when used
CC-05	Radiated Emissions Confidence Check	MiCOM	CC-05	None	10 Aug 2026

7.1.2. Conducted Test Setup [RF]

MiTest Automated Test System



A full system calibration was performed on the test station and any resulting system losses (or gains) were considered in the production of all final measurement data.

Asset#	Description	Manufacturer	Model#	Serial#	Calibration Due Date
#3 SA	MiTest Box to SA	Fairview Microwave	SCA1814-0101-72	#3 SA	8 Sep 2026
#3P1	EUT to MiTest box port 1	Fairview Microwave	SCA1814-0101-72	#3P1	8 Sep 2026
#3P2	EUT to MiTest box port 2	Fairview Microwave	SCA1814-0101-72	#3P2	8 Sep 2026
#3P3	EUT to MiTest box port 3	Fairview Microwave	SCA1814-0101-72	#3P3	8 Sep 2026
#3P4	EUT to MiTest box port 4	Fairview Microwave	SCA1812-0101-72	#3P4	8 Sep 2026
249	Thermocouple; Resistance Thermometer	Thermotronics	GR2105-02	9340 #2	22 Mar 2027
266	10 Hz to 50GHz MXA Signal Analyzer	Keysight	N9020B	MY60110791	17 Jun 2027
382	Tunable Notch Filter	Wainwright Instruments GmbH	WRCT800/960-0.2/40-8EEK	64	Cal when used
398	MiTest RF Conducted Test Software	MiCOM	MiTest ATS	Version 4.2.3.0	Not Required
405	DC Power Supply 0-60V	Agilent	6654A	MY4001826	Cal when used
408	USB to GPIB interface	National Instruments	GPIB-USB HS	14C0DE9	Not Required
441	USB Wideband Power Sensor	Boonton	55006	9179	4 Dec 2026

442	USB Wideband Power Sensor	Boonton	55006	9181	12 Dec 2026
461	Spectrum Analyzer	Agilent	E4440A	MY46185537	21 Aug 2027
494	USB Wideband Power Sensor	Boonton	55006	9726	12 Dec 2026
510	Barometer/Thermometer	Digi Sense	68000-49	170871375	4 Jan 2027
512	MiTest Cloud Solutions RF Test Box	MiCOM	2nd Gen	512	8 Sep 2026
516	USB Wideband Power Sensor	Boonton	RTP5006	10511	4 Dec 2026
555	Rhode & Schwarz Receiver (Firmware Version : 3.10 SP1)	Rhode & Schwarz	ESW 44	101893	14 Aug 2026

8. MEASUREMENT AND PRESENTATION OF TEST DATA

The measurement and graphical data presented in this test report was generated automatically using state-of-the-art technology creating an easy to read report structure. Numerical measurement data is separated from supporting graphical data (plots) through hyperlinks. Numerical measurement data can be reviewed without scrolling through numerous graphical pages to arrive at the next data matrix.

Plots have been relegated into the Appendix 'Graphical Data'.

Test and report automation was performed by [MiTest](#). [MiTest](#) is an automated test system developed by MiCOM Labs. [MiTest](#) is the first cloud based modular test system enabling end-to-end automation of regulatory compliance testing for conducted RF testing.



The MiCOM Labs "[MiTest](#)" Automated Test System" (Patent Pending)

9. TEST RESULTS

9.1. 20 dB & 99% Bandwidth

Conducted Test Conditions for 20 dB and 99% Bandwidth			
Standard:	FCC CFR 47:15.247, RSS-247	Ambient Temp. (°C):	24.0 - 27.5
Test Heading:	20 dB and 99 % Bandwidth	Rel. Humidity (%):	32 - 45
Standard Section(s):	15.247 (a)(1)(i)/(ii)	Pressure (mBars):	999 - 1001
Reference Document(s):	See Normative References		

Test Procedure for 20 dB and 99% Bandwidth Measurement

The bandwidth at 20 dB and 99 % was measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.

Testing was performed under ambient conditions at nominal voltage. Where the device operated with multiple antenna ports i.e. MIMO device, each port was measured and reported.

Test configuration and setup used for the measurement was per the Conducted Test Set-up specified in this document.

Limits for 20 dB and 99% Bandwidth

(a) Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

(i) For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

(ii) Frequency hopping systems operating in the 5725-5850 MHz band shall use at least 75 hopping frequencies. The maximum 20 dB bandwidth of the hopping channel is 1 MHz. The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 30 second period.

Equipment Configuration for 20 dB 99% Bandwidth

Variant:	2-GFSK-50k	Duty Cycle (%):	99
Data Rate:	50.00 KBit/s	Antenna Gain (dBi):	--
Modulation:	2-GFSK	Beam Forming Gain (Y)(dB):	Not Applicable
TPC:	Not Applicable	Tested By:	NN
Engineering Test Notes:	Max Power Setting		

Test Measurement Results

Test Frequency	Measured 20 dB Bandwidth (KHz)				20 dB Bandwidth (KHz)	Limit	Margin
	Port(s)						
MHz	a	b	c	d	Lowest	KHz	KHz
902.2	91.881	--	--	--	91.881	≤ 500	-408.119
915.0	88.194	--	--	--	88.194	≤ 500	-411.806
927.7	88.972	--	--	--	88.972	≤ 500	-411.028

Test Frequency	Measured 99% Bandwidth (KHz)				Maximum 99% Bandwidth (KHz)
	Port(s)				
MHz	a	b	c	d	
902.2	93.73	--	--	--	93.73
915.0	93.39	--	--	--	93.39
927.7	90.27	--	--	--	90.27

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

Note: click the links in the above matrix to view the graphical image (plot).

9.2. Frequency Hopping Tests

Conducted Test Conditions for Frequency Hopping Measurements			
Standard:	FCC CFR 47:15.247	Ambient Temp. (°C):	24.0 - 27.5
Test Heading:	Frequency Hopping Tests	Rel. Humidity (%):	32 - 45
Standard Section(s):	15.247 (a)(1)(i)/(ii)	Pressure (mBars):	999 - 1001
Reference Document(s):	See Normative References, FCC Public Notice DA 00-705		
Test Procedure for Frequency Hopping Measurements			
These tests cover the following measurements: i) channel separation ii) channel occupancy iii) dwell time iv) number of hopping frequencies			
Frequency hopping testing was measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency or hopping mode.			
Testing was performed under ambient conditions at nominal voltage. Where the device operated with multiple antenna ports i.e. MIMO device, each port was measured and reported.			
Test configuration and setup used for the measurement was per the Conducted Test Set-up specified in this document.			
Limits for Frequency Hopping Measurements			
(a) Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:			
(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.			
(i) For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.			
(ii) Frequency hopping systems operating in the 5725-5850 MHz band shall use at least 75 hopping frequencies. The maximum 20 dB bandwidth of the hopping channel is 1 MHz. The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 30 second period.			
(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.			

9.2.1. Number of Hopping Channels

Equipment Configuration for Number of Hopping Channels			
Variant:	2-GFSK-50k	Duty Cycle (%):	99
Data Rate:	50.00 KBit/s	Antenna Gain (dBi):	--
Modulation:	2-GFSK	Beam Forming Gain (Y)(dB):	Not Applicable
Duty Cycle (%):	Not Applicable	Tested By:	NN
Engineering Test Notes:			

Test Measurement Results

Frequency Range (MHz)	Number of Hopping Channels	Limit	Pass / Fail
902.0-915	64	---	---
915.0-928.0	64	---	---
Total number of Hops	128	50	Pass

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

Note: click the links in the above matrix to view the graphical image (plot).

9.2.2. Channel Separation

Equipment Configuration for Channel Separation			
--	--	--	--

Variant:	2-GFSK-50k	Duty Cycle (%):	99
Data Rate:	50.00 KBit/s	Antenna Gain (dBi):	--
Modulation:	2-GFSK	Beam Forming Gain (Y)(dB):	Not Applicable
Duty Cycle (%):	Not Applicable	Tested By:	NN
Engineering Test Notes:	20dB BW is greater than 25KHz.		

Test Measurement Results

Center Frequency (MHz)	Chan Separation (KHz)	Limit (KHz)	Pass / Fail
915.0	200	≥91.881	Pass

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

Note: click the links in the above matrix to view the graphical image (plot).

9.2.3. Channel Occupancy & Dwell Time

Equipment Configuration for Channel Occupancy

Variant:	2-GFSK-50k	Duty Cycle (%):	99
Data Rate:	50.00 KBit/s	Antenna Gain (dBi):	--
Modulation:	2-GFSK	Beam Forming Gain (Y)(dB):	Not Applicable
Duty Cycle (%):	Not Applicable	Tested By:	NN
Engineering Test Notes:			

Test Measurement Results

Channel Frequency (MHz)	Dwell Time (Single Burst) (mS)	Number of Hops	20 sec equivalent observation period= 20 sec/ Analyzer sweep time in sec	Number of Hops in 20 Sec	Channel Occupancy (mS)	Channel Occupancy Limit (mS)	Pass / Fail
915.00	610	2	20/300=0.0666	0.1333	81.33	400.000	Pass

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

Note: click the links in the above matrix to view the graphical image (plot).

9.3. Output Power

Conducted Test Conditions for Fundamental Emission Output Power			
Standard:	FCC CFR 47:15.247	Ambient Temp. (°C):	24.0 - 27.5
Test Heading:	Output Power	Rel. Humidity (%):	32 - 45
Standard Section(s):	15.247 (a)(1), (b)(1)/(2)/(3)	Pressure (mBars):	999 - 1001
Reference Document(s):	See Normative References		

Test Procedure for Fundamental Emission Output Power Measurement

In the case of average power measurements an average power sensor was utilized.

For peak power measurements the spectrum analyzer built-in power function was used to integrate peak power over the 20 dB bandwidth.

Testing was performed under ambient conditions, nominal voltage. Where the device operated with multiple antenna ports i.e. MIMO device, each port was measured, summed (Σ) and reported.

Test configuration and setup used for the measurement was per the Conducted Test Set-up specified in this document.

Supporting Information

Calculated Power = A + G + Y + 10 log (1/x) dBm

A = Total Power [10*Log10 (10^{a/10} + 10^{b/10} + 10^{c/10} + 10^{d/10})]

G = Antenna Gain

Y = Beamforming Gain

x = Duty Cycle (average power measurements only)

Limits for Fundamental Emission Output Power

(a) Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

(b) The maximum peak conducted output power of the intentional radiator shall not exceed the following for frequency hopping systems:

(1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

(2) For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

(3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

Equipment Configuration for Output Power Peak

Variant:	2-GFSK-50k	Duty Cycle (%):	99
Data Rate:	50.00 KBit/s	Antenna Gain (dBi):	--
Modulation:	2-GFSK	Beam Forming Gain (Y)(dB):	Not Applicable
TPC:	Not Applicable	Tested By:	NN
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Measured Output Power (dBm)				Calculated Total Power Σ Port(s)	Limit	Margin	EUT Power Setting
	Port(s)							
MHz	a	b	c	d	dBm	dBm	dB	
902.2	14.13	--	--	--	14.13	30.00	-15.87	14.00
915.0	13.91	--	--	--	13.91	30.00	-16.09	14.00
927.7	14.06	--	--	--	14.06	30.00	-15.94	14.00

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-01 MEASURING RF OUTPUT POWER
Measurement Uncertainty:	± 1.33 dB

The above measurements are true pulse readings and therefore a Duty Cycling correction factor is not required.

9.4. Emissions

9.4.1. Conducted Emissions

Conducted Test Conditions for Transmitter Conducted Spurious and Band-Edge Emissions			
Standard:	FCC CFR 47:15.247	Ambient Temp. (°C):	24.0 - 27.5
Test Heading:	Transmitter Conducted Spurious and Band-Edge Emissions	Rel. Humidity (%):	32 - 45
Standard Section(s):	15.247 (d)	Pressure (mBars):	999 - 1001
Reference Document(s):	See Normative References		

Test Procedure for Transmitter Conducted Spurious and Band-Edge Emissions Measurement

Transmitter Conducted Spurious and Band-Edge emissions were measured at a limit of 30 dBc (average detector) or 20 dBc (peak detector) below the highest in-band spectral density measured with a spectrum analyzer connected to the antenna terminal. Measurements were made while EUT was operating in transmit mode of operation at the appropriate centre frequency closest to the band-edge. Emissions were maximized during the measurement and limits derived from the peak spectral power and drawn on each plot.

Where the device operated with multiple antenna ports i.e. MIMO device, each port was measured separately. Testing was performed under ambient conditions at nominal voltage only.

Test configuration and setup used for the measurement was per the Conducted Test Set-up specified in this document.

Limits Transmitter Conducted Spurious and Band-Edge Emissions

(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

9.4.1.1. Conducted Unwanted Spurious Emissions

Equipment Configuration for Unwanted Emissions Peak			
Variant:	2-GFSK-50k	Duty Cycle (%):	99
Data Rate:	50.00 KBit/s	Antenna Gain (dBi):	--
Modulation:	2-GFSK	Beam Forming Gain (Y)(dB):	Not Applicable
TPC:	Not Applicable	Tested By:	NN
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Frequency Range	Unwanted Emissions Peak (dBm)							
		Port a		Port b		Port c		Port d	
MHz	MHz	SE	Limit	SE	Limit	SE	Limit	SE	Limit
902.2	30.0 - 26000.0	-33.80	-22.29	--	--	--	--	--	--
915.0	30.0 - 26000.0	-36.14	-22.59	--	--	--	--	--	--
927.7	30.0 - 26000.0	-37.58	-23.03	--	--	--	--	--	--

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-05 MEASUREMENT OF SPURIOUS EMISSIONS
Measurement Uncertainty:	<=40 GHz ± 2.37 dB, > 40 GHz ± 4.6 dB

Note: click the links in the above matrix to view the graphical image (plot).

9.4.1.2. Conducted Band-Edge Emissions

Equipment Configuration for Conducted Low Band-Edge Emissions (Static) Peak

Variant:	2-GFSK-50k	Duty Cycle (%):	99
Data Rate:	50.00 KBit/s	Antenna Gain (dBi):	--
Modulation:	2-GFSK	Beam Forming Gain (Y)(dB):	Not Applicable
TPC:	Not Applicable	Tested By:	NN
Engineering Test Notes:			

Test Measurement Results

Channel Frequency:	902.2 MHz					
Band-Edge Frequency:	902.0 MHz					
Test Frequency Range:	875.0 - 905.0 MHz					
Port(s)	Band-Edge Markers and Limit			Revised Limit		Margin
	M1 Amplitude (dBm)	Plot Limit (dBm)	M2 Frequency (MHz)	Amplitude (dBm)	M2A Frequency (MHz)	(MHz)
a	-39.89	-22.42	902.00			-0.042

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-05 MEASUREMENT OF SPURIOUS EMISSIONS
Measurement Uncertainty:	<=40 GHz ±2.37 dB, > 40 GHz ±4.6 dB

Note: click the links in the above matrix to view the graphical image (plot).

Equipment Configuration for Conducted Low Band-Edge Emissions (Hopping) Peak

Variant:	2-GFSK-50k	Duty Cycle (%):	99
Data Rate:	50.00 KBit/s	Antenna Gain (dBi):	--
Modulation:	2-GFSK	Beam Forming Gain (Y)(dB):	Not Applicable
TPC:	Not Applicable	Tested By:	NN
Engineering Test Notes:			

Test Measurement Results

Channel Frequency:	902.2 MHz					
Band-Edge Frequency:	902.0 MHz					
Test Frequency Range:	875.0 - 905.0 MHz					
Port(s)	Band-Edge Markers and Limit			Revised Limit		Margin
	M1 Amplitude (dBm)	Plot Limit (dBm)	M2 Frequency (MHz)	Amplitude (dBm)	M2A Frequency (MHz)	(MHz)
a	-45.53	-22.34	902.00			-0.042

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-05 MEASUREMENT OF SPURIOUS EMISSIONS
Measurement Uncertainty:	<=40 GHz ± 2.37 dB, > 40 GHz ± 4.6 dB

Note: click the links in the above matrix to view the graphical image (plot).

Equipment Configuration for Conducted Upper Band-Edge Emissions (Static) Peak

Variant:	2-GFSK-50k	Duty Cycle (%):	99
Data Rate:	50.00 KBit/s	Antenna Gain (dBi):	--
Modulation:	2-GFSK	Beam Forming Gain (Y)(dB):	Not Applicable
TPC:	Not Applicable	Tested By:	NN
Engineering Test Notes:			

Test Measurement Results

Channel Frequency:	927.7 MHz					
Band-Edge Frequency:	928.0 MHz					
Test Frequency Range:	925.0 - 950.0 MHz					
Port(s)	Band-Edge Markers and Limit			Revised Limit		Margin
	M3 Amplitude (dBm)	Plot Limit (dBm)	M2 Frequency (MHz)	Amplitude (dBm)	M2A Frequency (MHz)	(MHz)
a	-51.16	-22.71	927.90			-0.100

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-05 MEASUREMENT OF SPURIOUS EMISSIONS
Measurement Uncertainty:	<=40 GHz ± 2.37 dB, > 40 GHz ± 4.6 dB

Note: click the links in the above matrix to view the graphical image (plot).

Equipment Configuration for Conducted Upper Band-Edge Emissions (Hopping) Peak

Variant:	2-GFSK-50k	Duty Cycle (%):	99
Data Rate:	50.00 KBit/s	Antenna Gain (dBi):	--
Modulation:	2-GFSK	Beam Forming Gain (Y)(dB):	Not Applicable
TPC:	Not Applicable	Tested By:	NN
Engineering Test Notes:			

Test Measurement Results

Channel Frequency:	907.7 MHz					
Band-Edge Frequency:	908 MHz					
Test Frequency Range:	925.0 - 950.0 MHz					
Port(s)	Band-Edge Markers and Limit			Revised Limit		Margin
	M1 Amplitude (dBm)	Plot Limit (dBm)	M2 Frequency (MHz)	Amplitude (dBm)	M2A Frequency (MHz)	(MHz)
a	-56.27	-22.66	927.90			-0.100

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-05 MEASUREMENT OF SPURIOUS EMISSIONS
Measurement Uncertainty:	<=40 GHz ± 2.37 dB, > 40 GHz ± 4.6 dB

Note: click the links in the above matrix to view the graphical image (plot).

9.4.2. Radiated Emissions

Frequency Band			
MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41			

(b) Except as provided in paragraphs (d) and (e) of this section, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.

(c) Except as provided in paragraphs (d) and (e) of this section, regardless of the field strength limits specified elsewhere in this subpart, the provisions of this section apply to emissions from any intentional radiator.

(d) The following devices are exempt from the requirements of this section:

- (1) Swept frequency field disturbance sensors operating between 1.705 and 37 MHz provided their emissions only sweep through the bands listed in paragraph (a) of this section, the sweep is never stopped with the fundamental emission within the bands listed in paragraph (a) of this section, and the fundamental emission is outside of the bands listed in paragraph (a) of this section more than 99% of the time the device is actively transmitting, without compensation for duty cycle.
- (2) Transmitters used to detect buried electronic markers at 101.4 kHz which are employed by telephone companies.
- (3) Cable locating equipment operated pursuant to §15.213.
- (4) Any equipment operated under the provisions of §15.253, 15.255, and 15.256 in the frequency band 75-85 GHz, or §15.257 of this part.
- (5) Biomedical telemetry devices operating under the provisions of §15.242 of this part are not subject to the restricted band 608-614 MHz but are subject to compliance within the other restricted bands.
- (6) Transmitters operating under the provisions of subparts D or F of this part.

(7) Devices operated pursuant to §15.225 are exempt from complying with this section for the 13.36-13.41 MHz band only.

(8) Devices operated in the 24.075-24.175 GHz band under §15.245 are exempt from complying with the requirements of this section for the 48.15-48.35 GHz and 72.225-72.525 GHz bands only, and shall not exceed the limits specified in §15.245(b).

(9) Devices operated in the 24.0-24.25 GHz band under §15.249 are exempt from complying with the requirements of this section for the 48.0-48.5 GHz and 72.0-72.75 GHz bands only, and shall not exceed the limits specified in §15.249(a).

(e) Harmonic emissions appearing in the restricted bands above 17.7 GHz from field disturbance sensors operating under the provisions of §15.245 shall not exceed the limits specified in §15.245(b).

9.4.2.3. TX Spurious & Restricted Band Emissions

9.4.2.3.1 Integral Antenna / Ignion (NN02-224)

30 MHz – 1 GHz

Equipment Configuration for 30 MHz TO 1 GHz

Antenna:	Integral Ignion (NN02-224)	Variant:	2-GFSK-50k
Antenna Gain (dBi):	2.1	Modulation:	2-GFSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	902.2	Data Rate:	50.00 KBit/s
Power Setting:	Max	Tested By:	NN

Test Measurement Results

30.00 - 1000.00 MHz

Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB/m	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail
#1	31.94	37.93	4.04	-5.34	36.62	MaxP	Vertical	100	239	40.0	-3.4	Pass
#2	32.91	29.97	4.05	-6.19	27.83	MaxP	Horizontal	149	180	40.0	-12.2	Pass
#3	190.05	29.60	4.72	-14.23	20.10	MaxP	Horizontal	199	120	43.5	-23.4	Pass
#4	210.42	32.28	4.78	-14.45	22.61	MaxP	Vertical	149	330	43.5	-20.9	Pass
#5	903.00	33.90	7.42	-2.45	38.87	Fundamental	Vertical	149	330	--	--	--
#6	999.03	40.11	7.62	-1.51	46.22	MaxP	Vertical	149	330	54.0	-7.8	Pass
#7	999.03	40.38	7.62	-1.51	46.49	MaxP	Horizontal	149	330	54.0	-7.5	Pass

Test Notes: 50kbps, 25khz deviation, 2-GFSK, 14dBm

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-05 MEASUREMENT OF SPURIOUS EMISSIONS;
Measurement Uncertainty:	<=40 GHz ±2.37 dB, > 40 GHz ±4.6 dB;

Equipment Configuration for 30 MHz TO 1 GHZ

Antenna:	Integral Ignion (NN02-224)	Variant:	2-GFSK-50k
Antenna Gain (dBi):	2.1	Modulation:	2-GFSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	915	Data Rate:	50.00 KBit/s
Power Setting:	Max	Tested By:	NN

Test Measurement Results

30.00 - 1000.00 MHz												
Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB/m	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail
#1	30.97	27.25	3.97	-4.56	26.66	MaxP	Horizontal	99	120	40.0	-13.3	Pass
#2	32.91	26.87	4.05	-6.19	24.73	MaxP	Vertical	149	179	40.0	-15.3	Pass
#3	196.84	30.56	4.76	-13.26	22.06	MaxP	Horizontal	199	120	43.5	-21.4	Pass
#4	481.05	30.29	5.81	-7.59	28.51	MaxP	Vertical	99	240	46.0	-17.5	Pass
#5	949.56	28.94	7.57	-1.95	34.56	MaxP	Vertical	149	0	46.0	-11.4	Pass
#6	978.66	28.96	7.64	-1.68	34.92	MaxP	Horizontal	149	240	54.0	-19.1	Pass

Test Notes: 50kbps, 25khz deviation, 2-GFSK, 14dBm

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-05 MEASUREMENT OF SPURIOUS EMISSIONS;
Measurement Uncertainty:	<=40 GHz ±2.37 dB, > 40 GHz ±4.6 dB;

Equipment Configuration for 30 MHz TO 1 GHZ

Antenna:	Integral Ignion (NN02-224)	Variant:	2-GFSK-50k
Antenna Gain (dBi):	2.1	Modulation:	2-GFSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	927.7	Data Rate:	50.00 KBit/s
Power Setting:	Max	Tested By:	NN

Test Measurement Results

30.00 - 1000.00 MHz												
Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB/m	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail
#1	31.94	27.36	4.04	-5.34	26.05	MaxP	Vertical	100	29	40.0	-13.9	Pass
#2	33.88	28.04	4.05	-6.90	25.18	MaxP	Horizontal	149	300	40.0	-14.8	Pass
#3	200.72	28.48	4.77	-12.96	20.28	MaxP	Horizontal	100	270	43.5	-23.2	Pass
#4	383.08	29.67	5.46	-10.23	24.89	MaxP	Vertical	199	0	46.0	-21.1	Pass
#5	928.22	42.53	7.51	-2.06	47.98	Fundamental	Horizontal	100	330	--	--	Pass
#6	988.36	28.68	7.57	-1.50	34.75	MaxP	Horizontal	199	240	54.0	-19.3	Pass
#7	995.15	27.96	7.57	-1.44	34.08	MaxP	Vertical	149	239	54.0	-19.9	Pass

Test Notes: 50kbps, 25khz deviation, 2-GFSK, 14dBm

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-05 MEASUREMENT OF SPURIOUS EMISSIONS;
Measurement Uncertainty:	<=40 GHz ±2.37 dB, > 40 GHz ±4.6 dB;

1 GHz -18 GHz

Equipment Configuration for FCC SPURIOUS 1 GHz -18 GHz

Antenna:	Integral Ignion (NN02-224)	Variant:	2-GFSK-50k
Antenna Gain (dBi):	2.1	Modulation:	2-GFSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	902.2	Data Rate:	50.00 KBit/s
Power Setting:	Max	Tested By:	NN

Test Measurement Results

1000.00 - 18000.00 MHz

Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB/m	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail
#1	1799.00	66.67	2.97	-14.67	54.97	MaxP	Horizontal	149	240	74.0	-19.0	Pass
#2	1799.00	48.06	2.97	-14.67	36.36	AVG	Horizontal	149	240	54.0	-17.6	Pass
#3	1799.00	61.05	2.97	-14.67	49.35	MaxP	Vertical	199	330	74.0	-24.6	Pass
#4	2700.00	56.47	3.69	-11.74	48.42	MaxP	Horizontal	199	0	74.0	-25.6	Pass
#5	2700.00	55.53	3.69	-11.74	47.47	MaxP	Vertical	199	330	74.0	-26.5	Pass
#6	11795.00	48.37	9.40	-5.72	52.06	MaxP	Vertical	149	149	74.0	-21.9	Pass
#7	12373.00	49.21	9.22	-6.15	52.28	MaxP	Horizontal	149	60	74.0	-21.7	Pass

Test Notes: 50kbps, 25khz deviation, 2-GFSK, 14dBm

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-05 MEASUREMENT OF SPURIOUS EMISSIONS;
Measurement Uncertainty:	<=40 GHz ±2.37 dB, > 40 GHz ±4.6 dB;

Equipment Configuration for FCC SPURIOUS 1 GHZ -18 GHZ

Antenna:	Integral Ignion (NN02-224)	Variant:	2-GFSK-50k
Antenna Gain (dBi):	2.1	Modulation:	2-GFSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	915	Data Rate:	50.00 KBit/s
Power Setting:	Max	Tested By:	NN

Test Measurement Results

1000.00 - 18000.00 MHz												
Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB/m	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail
#1	1816.00	64.65	2.98	-14.49	53.14	MaxP	Horizontal	149	300	74.0	-20.9	Pass
#2	1816.00	57.97	2.98	-14.49	46.46	MaxP	Vertical	149	330	74.0	-27.5	Pass
#3	2734.00	55.74	3.21	-11.55	47.40	MaxP	Vertical	149	330	74.0	-26.6	Pass
#4	9755.00	48.30	7.26	-6.11	49.45	MaxP	Horizontal	199	150	74.0	-24.6	Pass
#5	12764.00	49.96	9.14	-8.12	50.98	MaxP	Horizontal	199	90	74.0	-23.0	Pass
#6	13699.00	49.81	9.55	-6.78	52.58	MaxP	Vertical	149	59	74.0	-21.4	Pass

Test Notes: 50kbps, 25khz deviation, 2-GFSK, 14dBm

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-05 MEASUREMENT OF SPURIOUS EMISSIONS;
Measurement Uncertainty:	<=40 GHz ±2.37 dB, > 40 GHz ±4.6 dB;

Equipment Configuration for FCC SPURIOUS 1 GHZ -18 GHZ

Antenna:	Integral Ignion (NN02-224)	Variant:	2-GFSK-50k
Antenna Gain (dBi):	2.1	Modulation:	2-GFSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	927.7	Data Rate:	50.00 KBit/s
Power Setting:	Max	Tested By:	NN

Test Measurement Results

1000.00 - 18000.00 MHz												
Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB/m	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail
#1	1833.00	49.13	3.00	-14.45	37.69	MaxP	Vertical	149	209	74.0	-36.3	Pass
#2	1850.00	60.69	3.02	-14.40	49.31	MaxP	Horizontal	149	60	74.0	-24.7	Pass
#3	1850.00	43.96	3.02	-14.40	32.58	AVG	Horizontal	149	60	54.0	-21.4	Pass
#4	2768.00	56.08	3.22	-11.47	47.83	MaxP	Vertical	149	330	74.0	-26.2	Pass
#5	2785.00	56.78	3.76	-11.53	49.01	MaxP	Horizontal	199	0	74.0	-25.0	Pass
#6	11472.00	45.32	9.01	-5.47	48.86	MaxP	Horizontal	149	330	74.0	-25.1	Pass
#7	13325.00	51.61	9.40	-8.04	52.98	MaxP	Vertical	149	209	74.0	-21.0	Pass

Test Notes: 50kbps, 25khz deviation, 2-GFSK, 14dBm

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-05 MEASUREMENT OF SPURIOUS EMISSIONS;
Measurement Uncertainty:	<=40 GHz ±2.37 dB, > 40 GHz ±4.6 dB;

9.4.2.3.2 External Antenna / AVX Kyocera (X9000984-4GDSMB)

30 MHz – 1 GHz

Equipment Configuration for 30 MHz TO 1 GHz			
Antenna:	External / AVX Kyocera (X9000984-4GDSMB)	Variant:	2-GFSK-50k
Antenna Gain (dBi):	2.2	Modulation:	2-GFSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	902.2	Data Rate:	50.00 KBit/s
Power Setting:	Max	Tested By:	NN

Test Measurement Results

30.00 - 1000.00 MHz												
Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB/m	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail
#1	31.94	35.94	4.04	-5.34	34.64	MaxP	Vertical	100	149	40.0	-5.4	Pass
#2	31.94	28.82	4.04	-5.34	27.51	MaxP	Horizontal	199	270	40.0	-12.5	Pass
#3	191.99	37.41	4.75	-14.11	28.05	MaxP	Vertical	149	330	43.5	-15.5	Pass
#4	192.96	30.00	4.75	-14.01	20.73	MaxP	Horizontal	199	90	43.5	-22.8	Pass
#5	450.98	40.53	5.68	-8.40	37.82	MaxP	Horizontal	199	30	46.0	-8.2	Pass
#6	806.97	37.11	7.06	-3.56	40.61	MaxP	Vertical	149	209	46.0	-5.4	Pass
#7	903.00	47.96	7.42	-2.45	52.92	Fundamental	Vertical	199	119	--	--	--

Test Notes: External Ant, 14dBm, 50KBps, 25KHz Deviation, 2-GFSK.

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-05 MEASUREMENT OF SPURIOUS EMISSIONS;
Measurement Uncertainty:	<=40 GHz ±2.37 dB, > 40 GHz ±4.6 dB;

Equipment Configuration for 30 MHz TO 1 GHZ

Antenna:	External / AVX Kyocera (X9000984-4GDSMB)	Variant:	2-GFSK-50k
Antenna Gain (dBi):	2.2	Modulation:	2-GFSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	915	Data Rate:	50.00 KBit/s
Power Setting:	Max	Tested By:	NN

Test Measurement Results

30.00 - 1000.00 MHz												
Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB/m	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail
#1	31.94	37.83	4.04	-5.34	36.52	MaxP	Vertical	99	149	40.0	-3.5	Pass
#2	31.94	28.25	4.04	-5.34	26.95	MaxP	Horizontal	199	149	40.0	-13.1	Pass
#3	191.99	38.65	4.75	-14.11	29.29	MaxP	Vertical	149	330	43.5	-14.2	Pass
#4	191.99	41.72	4.75	-14.11	32.36	MaxP	Horizontal	99	149	43.5	-11.1	Pass
#5	457.77	42.66	5.74	-8.13	40.28	MaxP	Vertical	99	209	46.0	-5.7	Pass
#6	457.77	39.49	5.74	-8.13	37.10	MaxP	Horizontal	199	240	46.0	-8.9	Pass
#7	915.61	40.23	7.46	-2.30	45.39	Fundamental	Vertical	99	330	--	--	--
#8	915.61	40.22	7.46	-2.30	45.38	Fundamental	Horizontal	199	330	--	--	--

Test Notes: External Ant, 14dBm, 50KBps, 25KHz Deviation, 2-GFSK.

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-05 MEASUREMENT OF SPURIOUS EMISSIONS;
Measurement Uncertainty:	<=40 GHz ±2.37 dB, > 40 GHz ±4.6 dB;



Equipment Configuration for 30 MHz TO 1 GHZ

Antenna:	External / AVX Kyocera (X9000984-4GDSMB)	Variant:	2-GFSK-50k
Antenna Gain (dBi):	2.2	Modulation:	2-GFSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	927.7	Data Rate:	50.00 KBit/s
Power Setting:	Max	Tested By:	NN

Test Measurement Results

30.00 - 1000.00 MHz

Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB/m	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail
#1	32.91	39.61	4.05	-6.19	37.47	MaxP	Vertical	100	149	40.0	-2.5	Pass
#2	97.90	53.88	4.32	-16.36	41.84	MaxP	Vertical	149	330	43.5	-1.7	Pass
#3	97.90	54.14	4.32	-16.36	42.10	MaxP	Horizontal	149	180	43.5	-1.4	Pass
#4	191.99	42.19	4.75	-14.11	32.83	MaxP	Horizontal	100	120	43.5	-10.7	Pass
#5	463.59	42.27	5.75	-7.91	40.11	MaxP	Vertical	100	179	46.0	-5.9	Pass
#6	746.83	31.38	6.86	-4.14	34.10	MaxP	Horizontal	100	210	46.0	-11.9	Pass
#7	928.22	45.51	7.51	-2.06	50.96	Fundamental	Vertical	149	29	--	--	Pass

Test Notes: External Ant, 14dBm, 50KBps, 25KHz Deviation, 2-GFSK.

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-05 MEASUREMENT OF SPURIOUS EMISSIONS;
Measurement Uncertainty:	<=40 GHz ±2.37 dB, > 40 GHz ±4.6 dB;

1 GHz -18 GHz

Equipment Configuration for FCC SPURIOUS 1 GHZ -18 GHZ

Antenna:	External / AVX Kyocera (X9000984-4GDSMB)	Variant:	2-GFSK-50k
Antenna Gain (dBi):	2.2	Modulation:	2-GFSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	902.2	Data Rate:	50.00 KBit/s
Power Setting:	Max	Tested By:	NN

Test Measurement Results

1000.00 - 18000.00 MHz												
Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB/m	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail
#1	1799.00	60.34	2.97	-14.67	48.64	MaxP	Horizontal	150	300	74.0	-25.4	Pass
#2	1799.00	62.33	2.97	-14.67	50.63	MaxP	Vertical	150	0	74.0	-23.4	Pass
#3	1799.00	44.78	2.97	-14.67	33.08	AVG	Vertical	150	29	54.0	-20.9	Pass
#4	1799.00	43.67	2.97	-14.67	31.97	AVG	Horizontal	150	300	54.0	-22.0	Pass
#5	5386.00	50.61	5.50	-11.30	44.81	MaxP	Horizontal	199	0	74.0	-29.2	Pass
#6	6032.00	49.21	6.03	-9.67	45.57	MaxP	Vertical	150	239	74.0	-28.4	Pass
#7	9517.00	47.59	7.21	-6.19	48.61	MaxP	Vertical	199	330	74.0	-25.4	Pass
#8	14634.00	47.38	9.23	-5.39	51.23	MaxP	Horizontal	199	330	74.0	-22.8	Pass

Test Notes: 50kbps, 25khz deviation, 2-GFSK, 14dBm

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-05 MEASUREMENT OF SPURIOUS EMISSIONS;
Measurement Uncertainty:	<=40 GHz ±2.37 dB, > 40 GHz ±4.6 dB;

Equipment Configuration for FCC SPURIOUS 1 GHZ -18 GHZ

Antenna:	External / AVX Kyocera (X9000984-4GDSMB)	Variant:	2-GFSK-50k
Antenna Gain (dBi):	2.2	Modulation:	2-GFSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	915	Data Rate:	50.00 KBit/s
Power Setting:	Max	Tested By:	NN

Test Measurement Results

1000.00 - 18000.00 MHz												
Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB/m	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail
#1	1799.00	48.74	2.97	-14.67	37.04	MaxP	Horizontal	149	30	74.0	-37.0	Pass
#2	1816.00	60.84	2.98	-14.49	49.33	MaxP	Vertical	149	0	74.0	-24.7	Pass
#3	1816.00	43.70	2.98	-14.49	32.19	AVG	Vertical	150	0	54.0	-21.8	Pass
#4	1816.00	42.44	2.98	-14.49	30.93	AVG	Horizontal	149	240	54.0	-23.1	Pass
#5	4638.00	51.98	4.98	-12.01	44.95	MaxP	Horizontal	199	300	74.0	-29.1	Pass
#6	6729.00	49.09	6.25	-7.74	47.60	MaxP	Vertical	199	299	74.0	-26.4	Pass
#7	10605.00	46.83	8.11	-4.72	50.22	MaxP	Horizontal	199	60	74.0	-23.8	Pass
#8	12730.00	50.55	9.15	-7.74	51.96	MaxP	Vertical	199	0	74.0	-22.0	Pass

Test Notes: 50kbps, 25khz deviation, 2-GFSK, 14dBm

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-05 MEASUREMENT OF SPURIOUS EMISSIONS;
Measurement Uncertainty:	<=40 GHz ±2.37 dB, > 40 GHz ±4.6 dB;

Equipment Configuration for FCC SPURIOUS 1 GHZ -18 GHZ

Antenna:	External / AVX Kyocera (X9000984-4GDSMB)	Variant:	2-GFSK-50k
Antenna Gain (dBi):	2.2	Modulation:	2-GFSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	927.7	Data Rate:	50.00 KBit/s
Power Setting:	Max	Tested By:	NN

Test Measurement Results

1000.00 - 18000.00 MHz												
Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB/m	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail
#1	1850.00	58.58	3.02	-14.40	47.20	MaxP	Vertical	199	179	74.0	-26.8	Pass
#2	1850.00	55.74	3.02	-14.40	44.36	MaxP	Horizontal	150	240	74.0	-29.6	Pass
#3	1850.00	42.69	3.02	-14.40	31.30	AVG	Vertical	150	89	54.0	-22.7	Pass
#4	1850.00	40.46	3.02	-14.40	29.07	AVG	Horizontal	150	240	54.0	-24.9	Pass
#5	5335.00	49.08	5.44	-11.41	43.12	MaxP	Horizontal	199	330	74.0	-30.9	Pass
#6	6151.00	46.83	6.14	-9.11	43.87	MaxP	Vertical	150	119	74.0	-30.1	Pass
#7	10401.00	45.72	7.79	-4.76	48.76	MaxP	Horizontal	199	30	74.0	-25.2	Pass
#8	10758.00	45.35	8.20	-5.69	47.86	MaxP	Vertical	199	0	74.0	-26.1	Pass

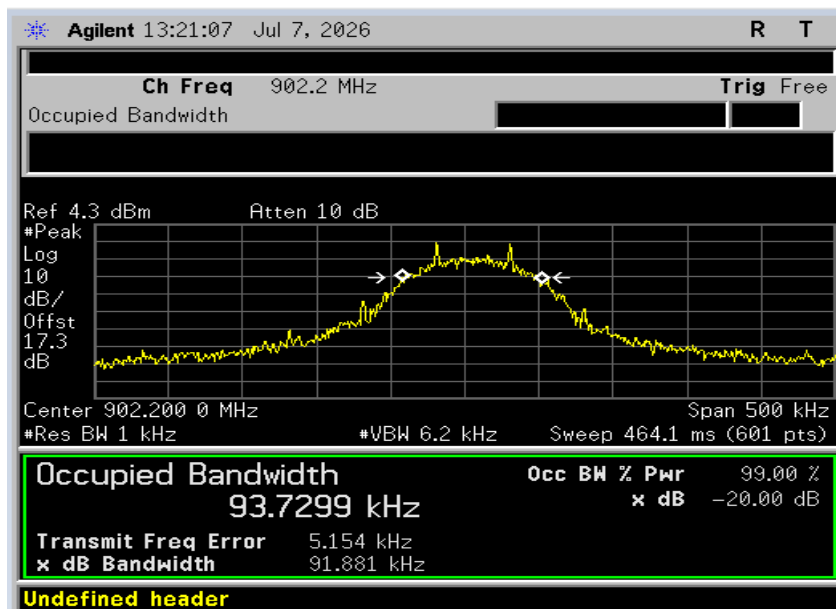
Test Notes: 50kbps, 25khz deviation, 2-GFSK, 14dBm

Traceability to Industry Recognized Test Methodologies

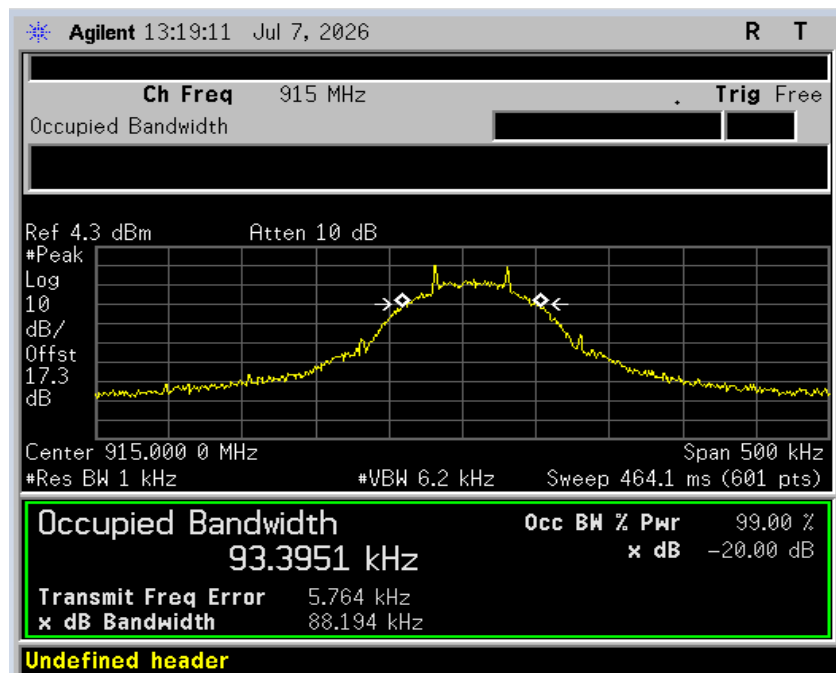
Work Instruction:	WI-05 MEASUREMENT OF SPURIOUS EMISSIONS;
Measurement Uncertainty:	<=40 GHz ±2.37 dB, > 40 GHz ±4.6 dB;

A. APPENDIX - GRAPHICAL IMAGES

A.1. 20 dB & 99% Bandwidth

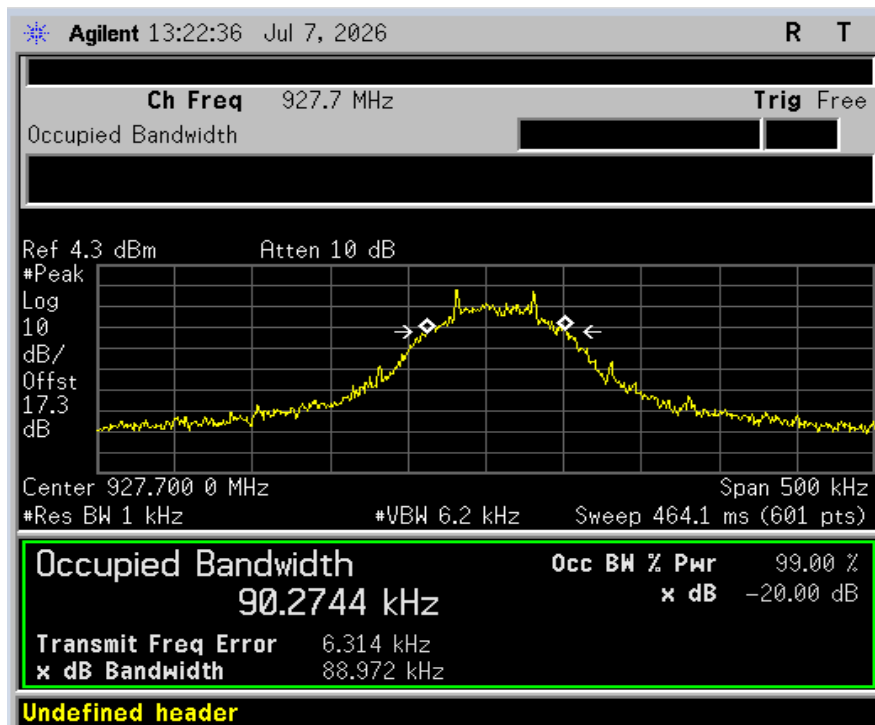


902.2 MHz 50Kbps.



915 MHz 50Kbps.

[BACK TO MATRIX](#)

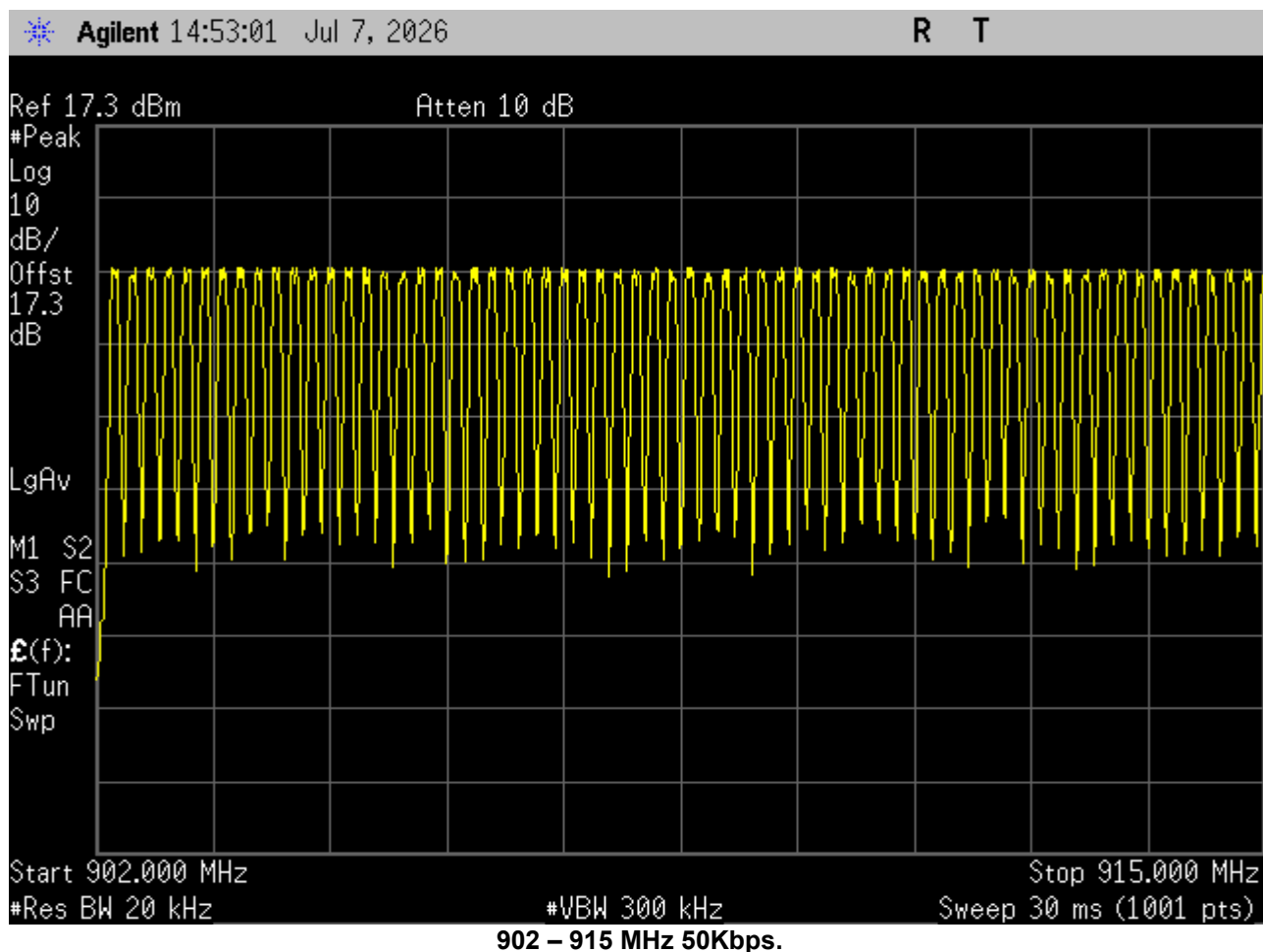


927.7 MHz 50Kbps.

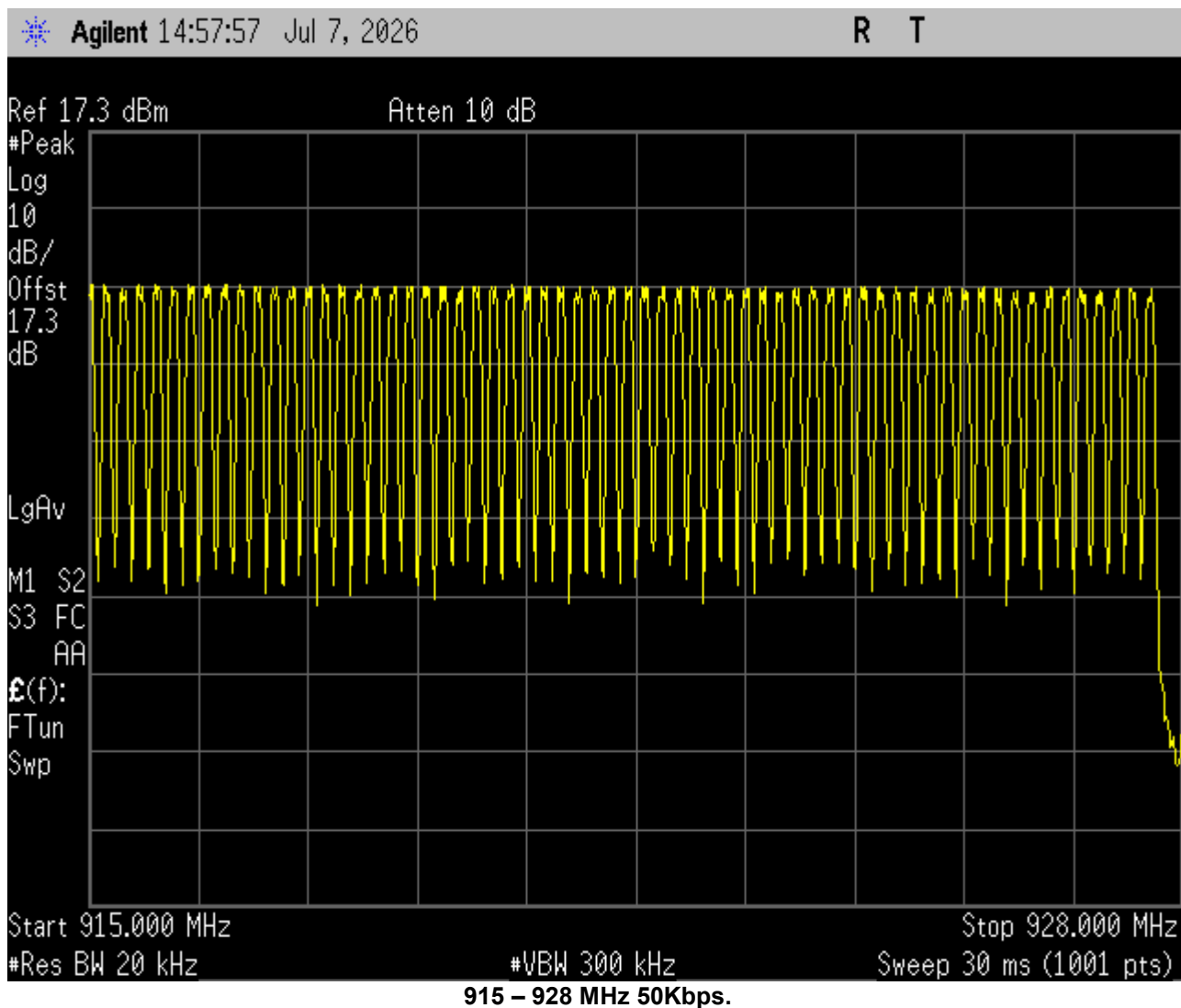
[BACK TO MATRIX](#)

A.2. Frequency Hopping Tests

A.2.1. Number of Hopping Channels

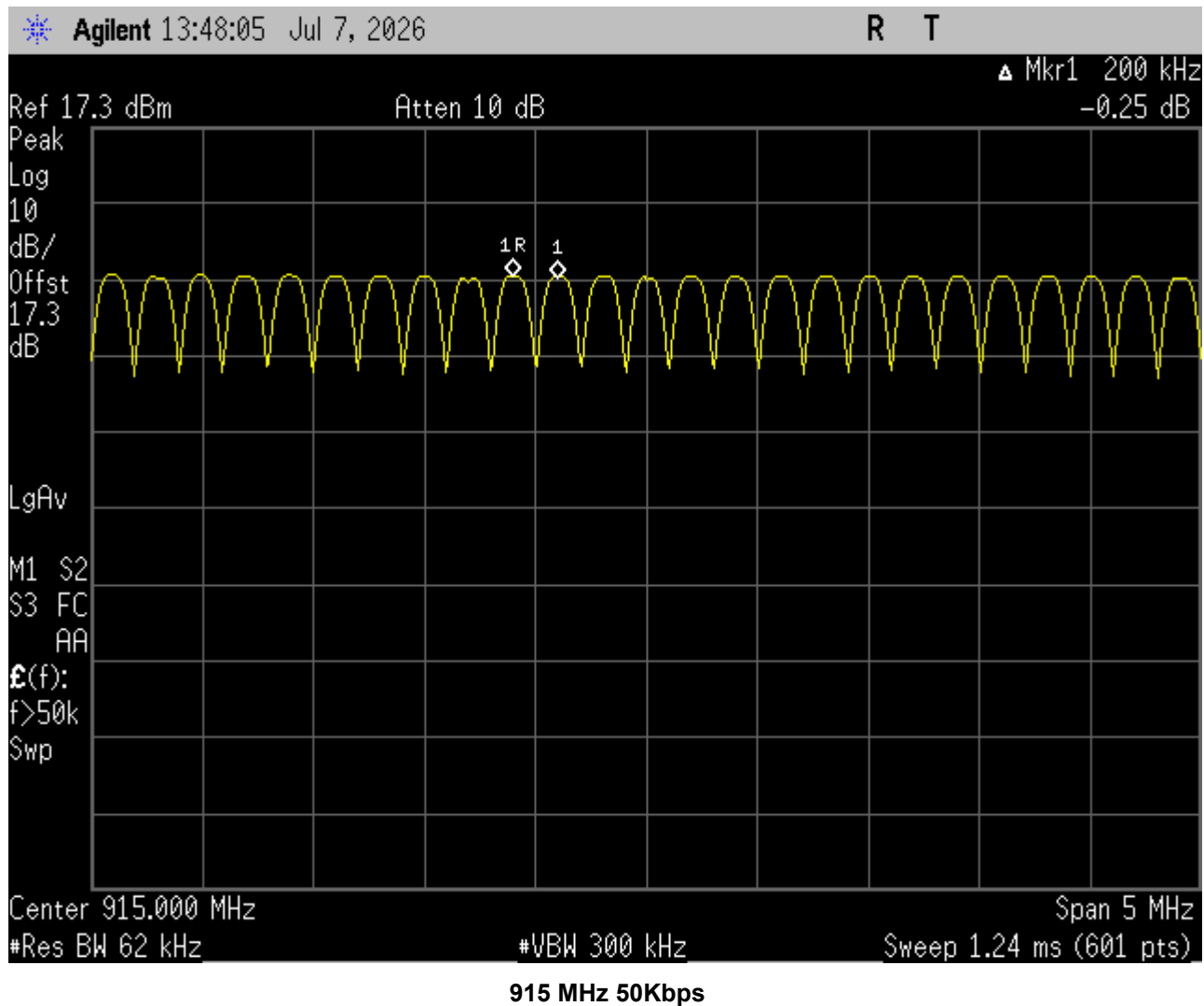


[BACK TO MATRIX](#)



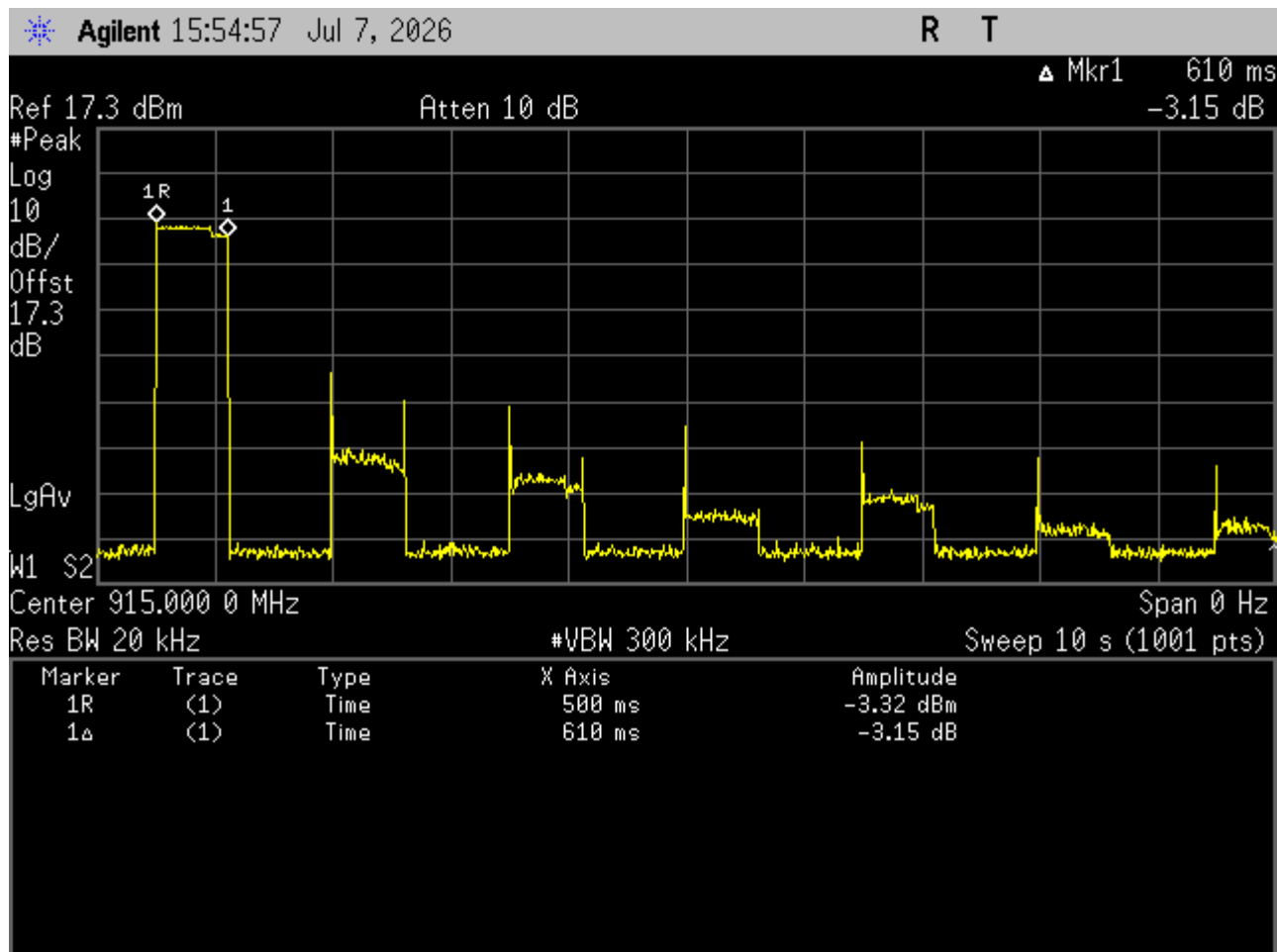
[BACK TO MATRIX](#)

A.2.2. Channel Separation



[BACK TO MATRIX](#)

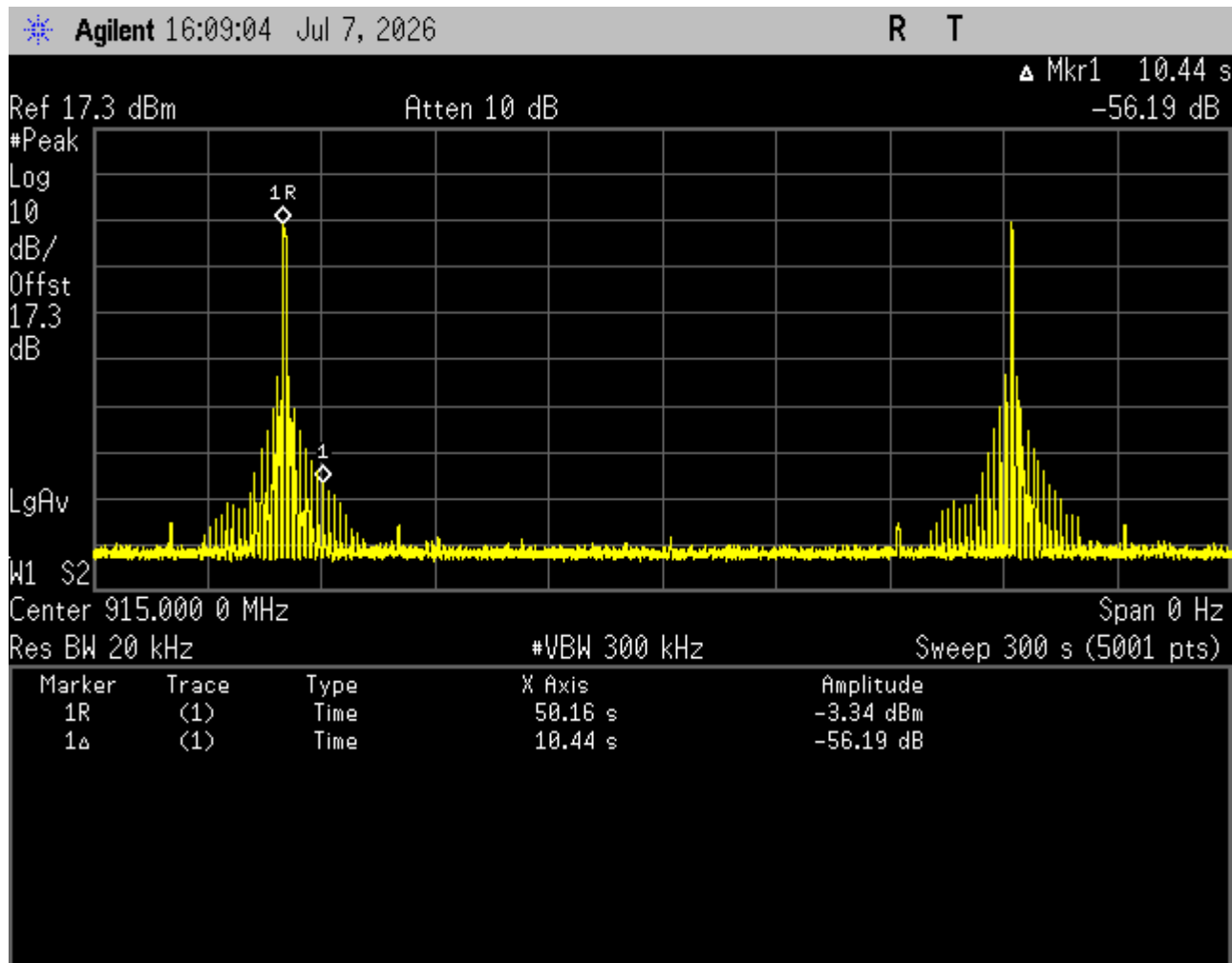
A.2.3. Dwell Time



915MHz 50Kbps.

[BACK TO MATRIX](#)

A.2.4. Channel Occupancy



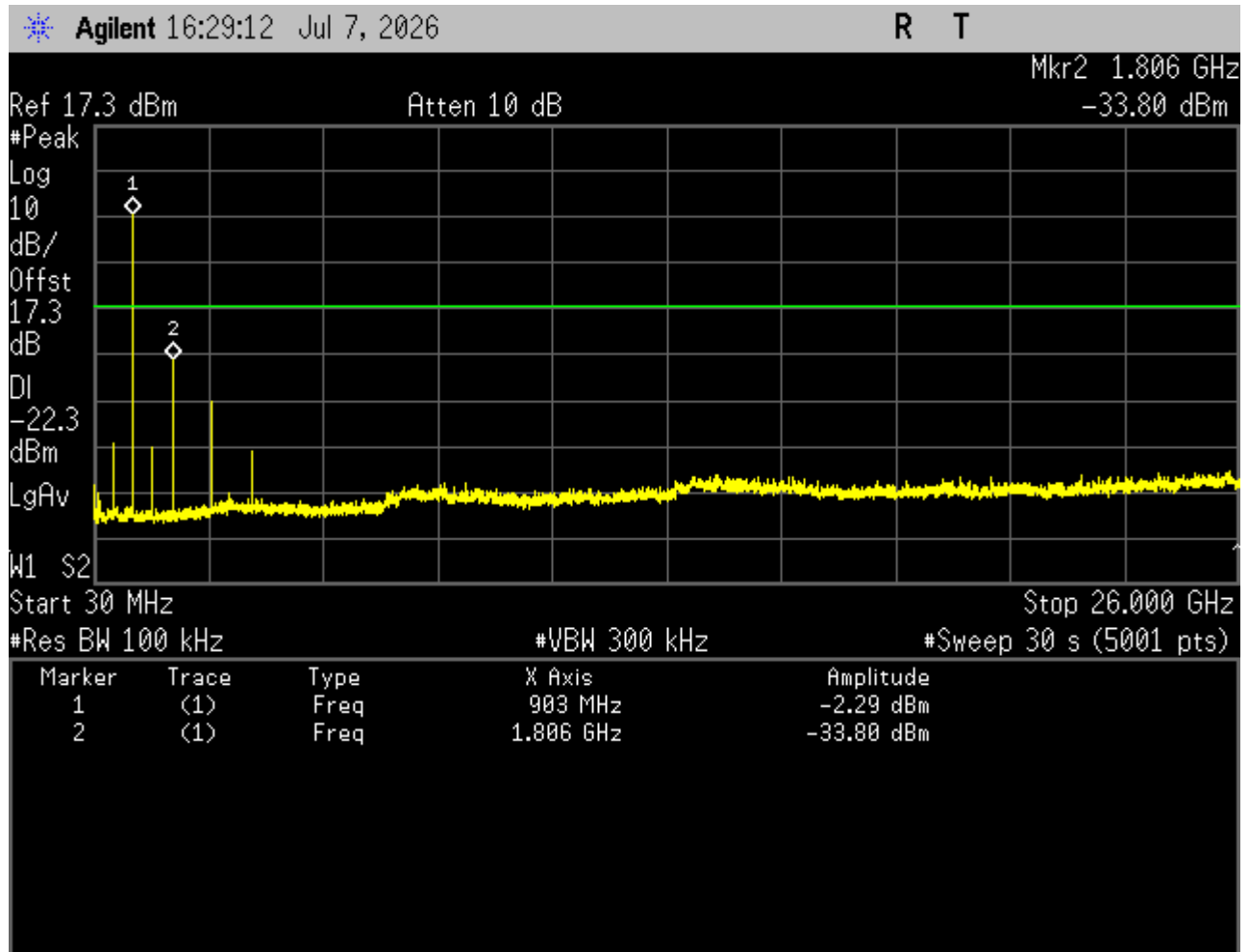
915MHz 50Kbps.

[BACK TO MATRIX](#)

A.3. Emissions

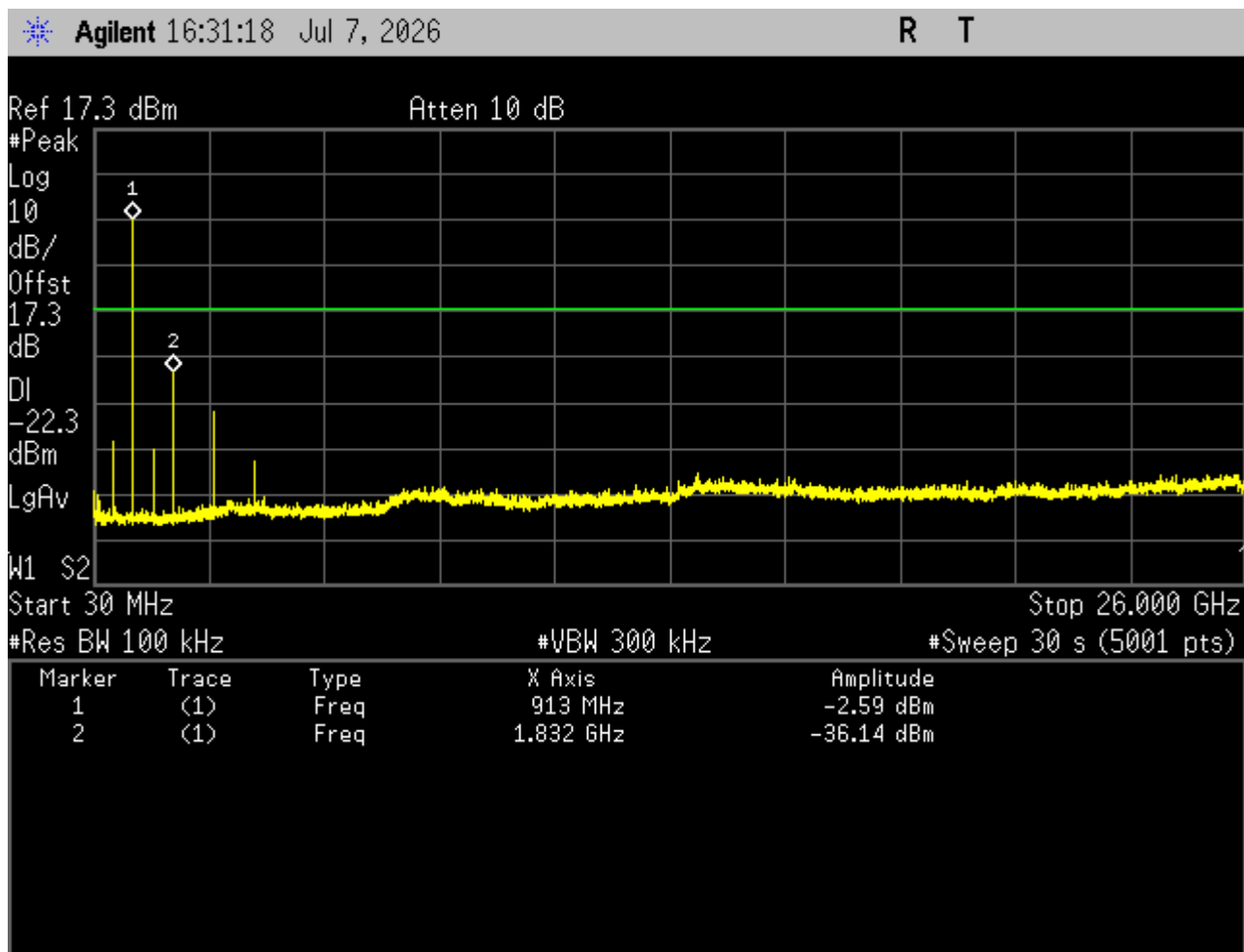
A.3.1. Conducted Emissions

A.3.1.1. Conducted Unwanted Spurious Emissions



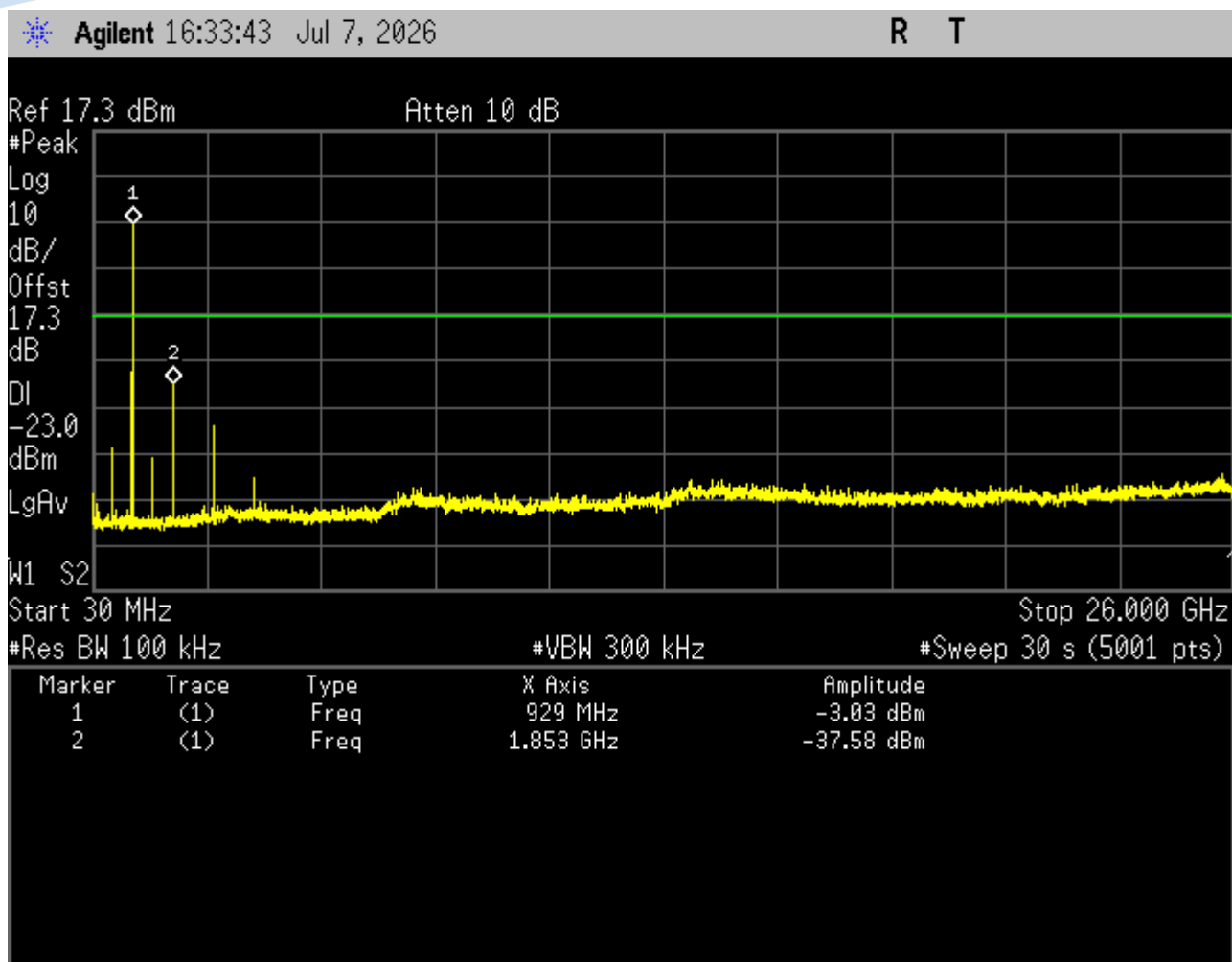
902.2 MHz 50Kbps

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915 MHz 50Kbps

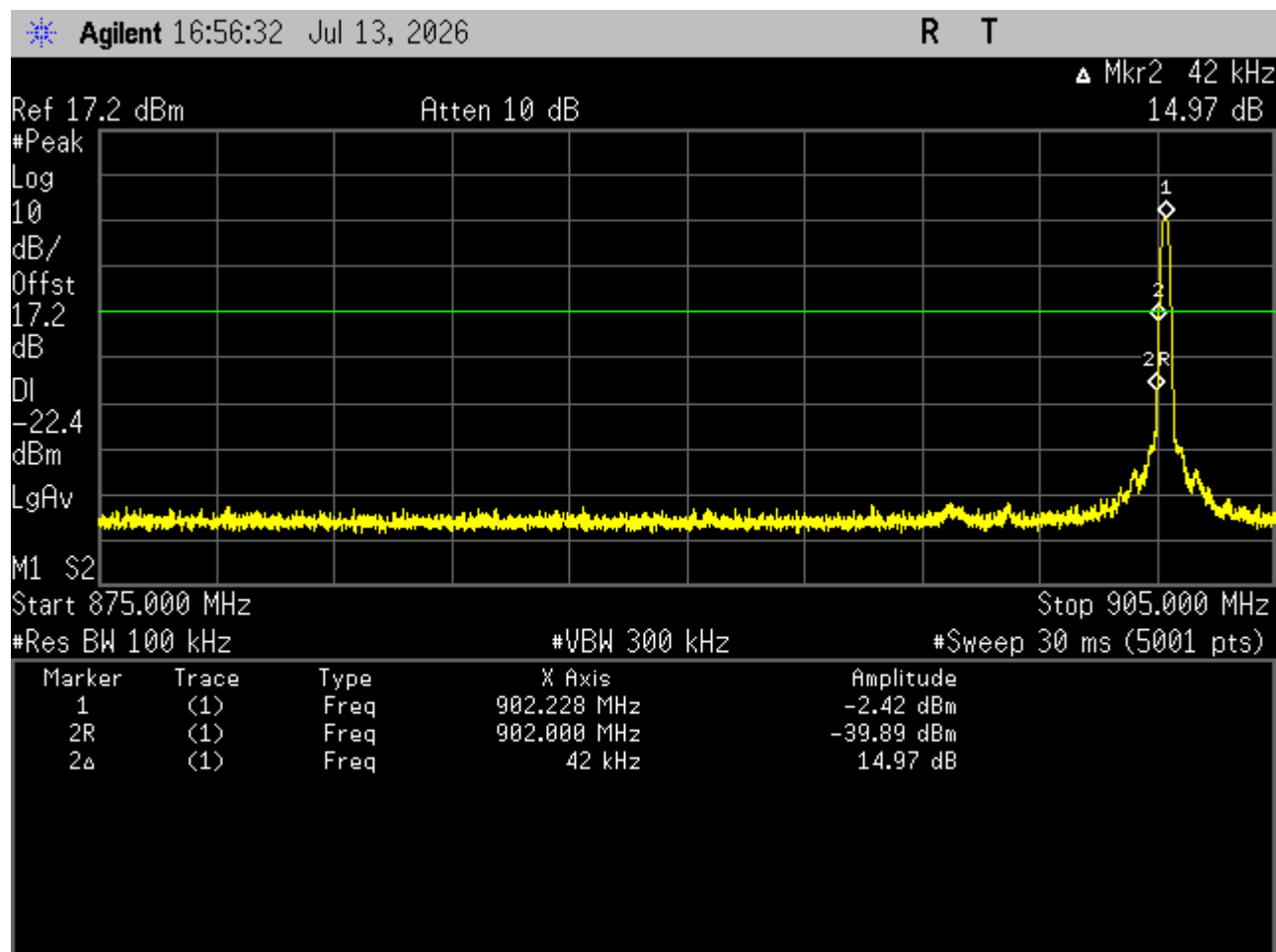
[BACK TO MATRIX](#)



927.7 MHz 50Kbps

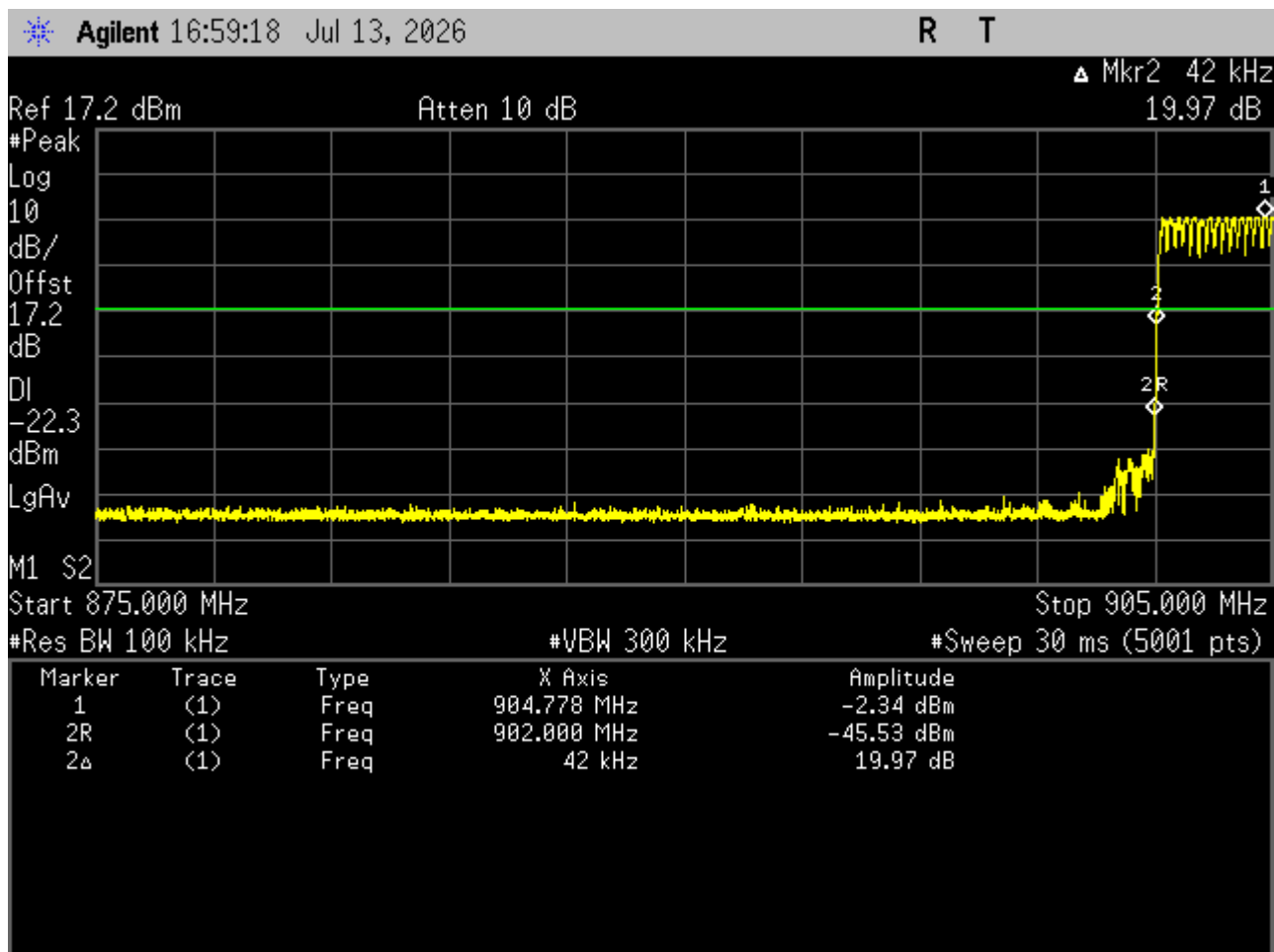
[BACK TO MATRIX](#)

A.3.1.2. Conducted Band-Edge Emissions



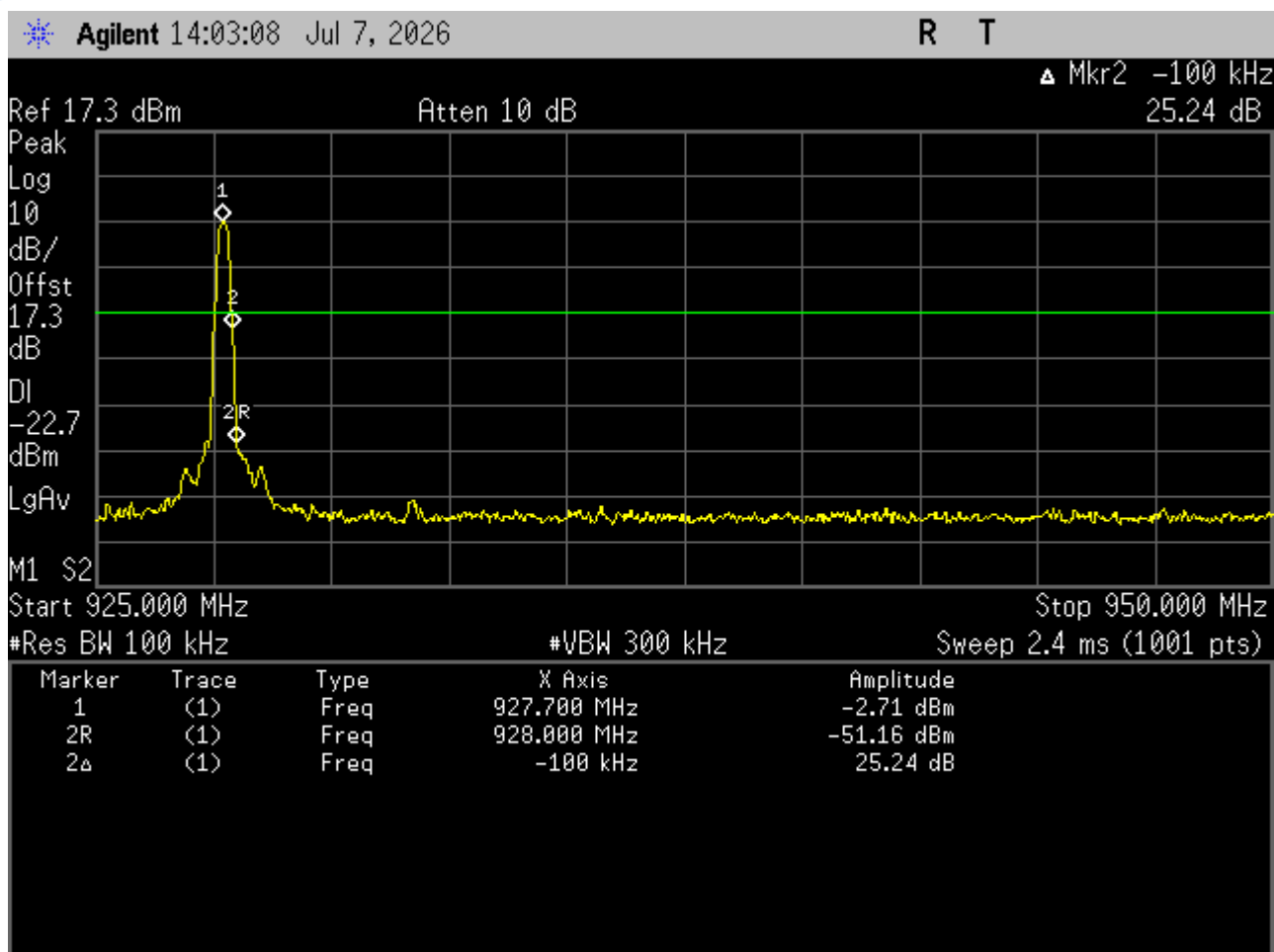
902.2 MHz 50 Kbps Static Low Band-edge.

[BACK TO MATRIX](#)



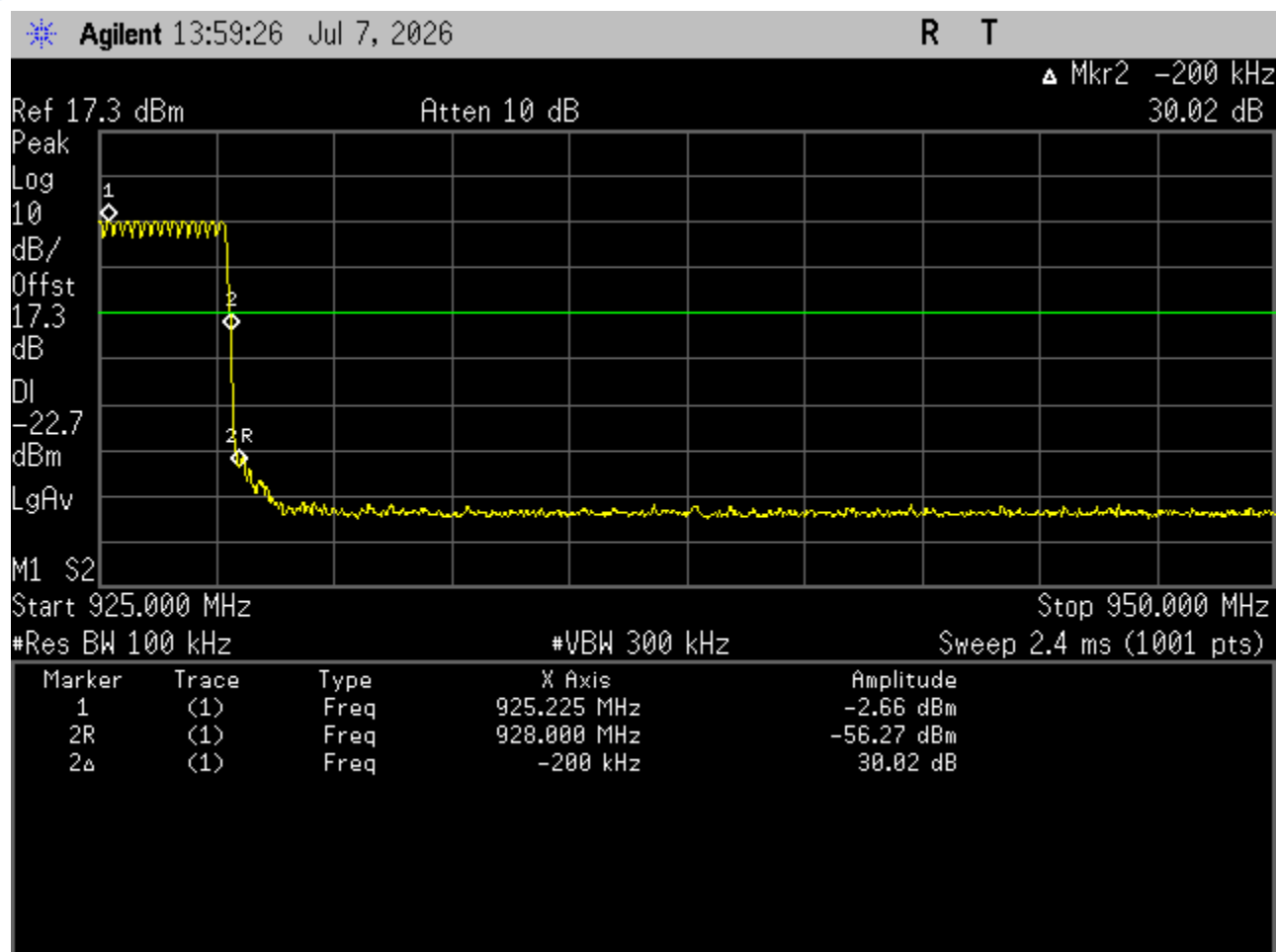
902.2 MHz 50 Kbps Hopping Low Band-edge.

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927.7 MHz 50 Kbps Static Upper Band-edge.

[BACK TO MATRIX](#)



927.7 MHz 50 Kbps Hopping Upper Band-edge.

[BACK TO MATRIX](#)

A.3.2. Radiated Emissions

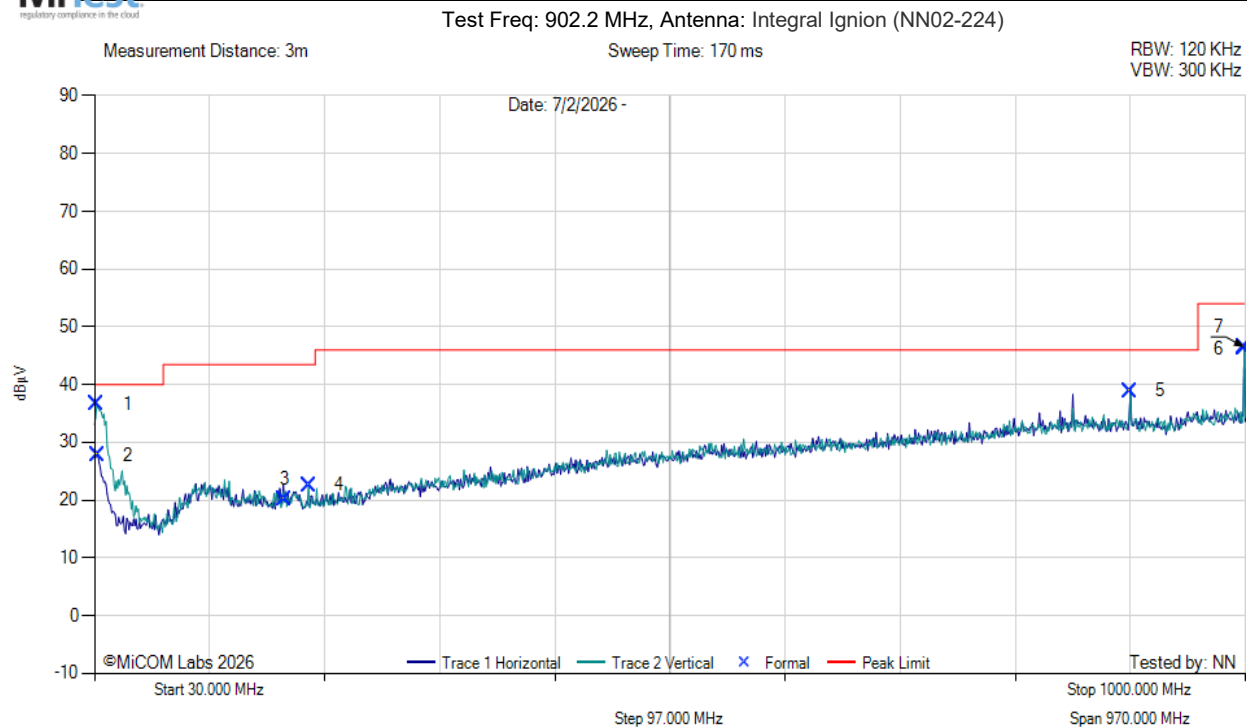
A.3.2.3. TX Spurious & Restricted Band Emissions

A.4.2.3.1 Integral Antenna / Ignion (NN02-224)

30MHz - 1GHz



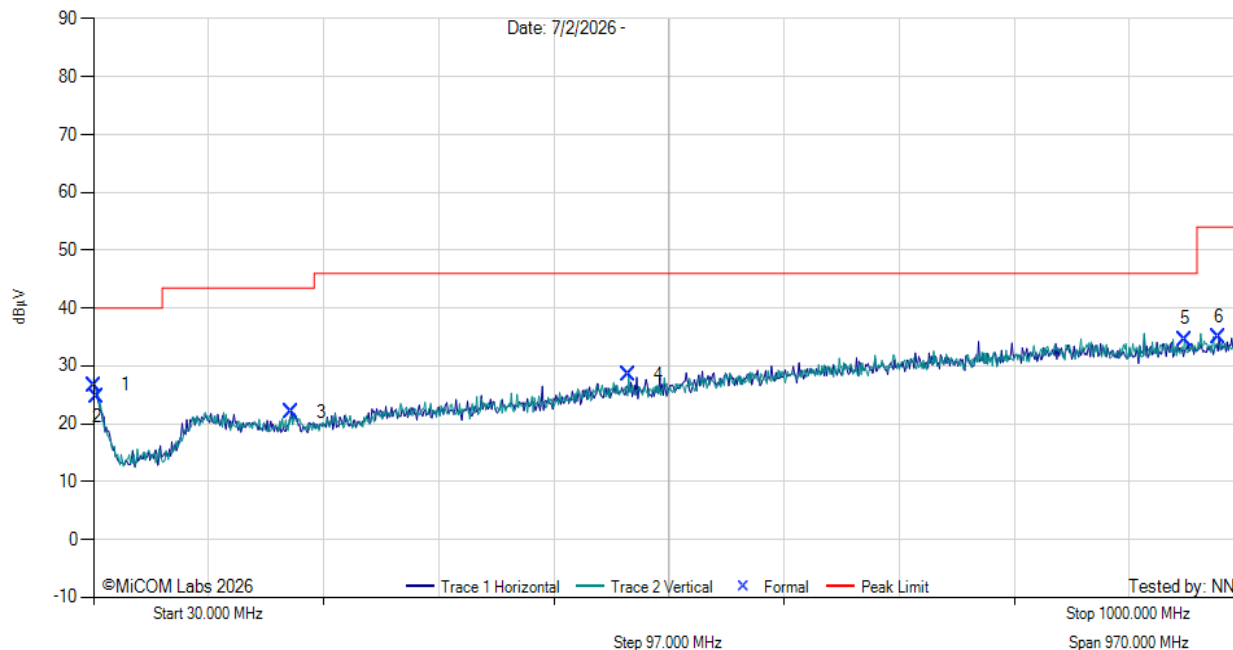
30 MHz to 1 GHz



30.00 - 1000.00 MHz												
Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB/m	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail
1	31.94	37.93	4.04	-5.34	36.62	MaxP	Vertical	100	239	40.0	-3.4	Pass
2	32.91	29.97	4.05	-6.19	27.83	MaxP	Horizontal	149	180	40.0	-12.2	Pass
3	190.05	29.60	4.72	-14.23	20.10	MaxP	Horizontal	199	120	43.5	-23.4	Pass
4	210.42	32.28	4.78	-14.45	22.61	MaxP	Vertical	149	330	43.5	-20.9	Pass
5	903.00	33.90	7.42	-2.45	38.87	Fundamental	Vertical	149	330	--	--	--
6	999.03	40.11	7.62	-1.51	46.22	MaxP	Vertical	149	330	54.0	-7.8	Pass
7	999.03	40.38	7.62	-1.51	46.49	MaxP	Horizontal	149	330	54.0	-7.5	Pass

Test Notes: 50kbps, 25khz deviation, 2-GFSK, 14dBm

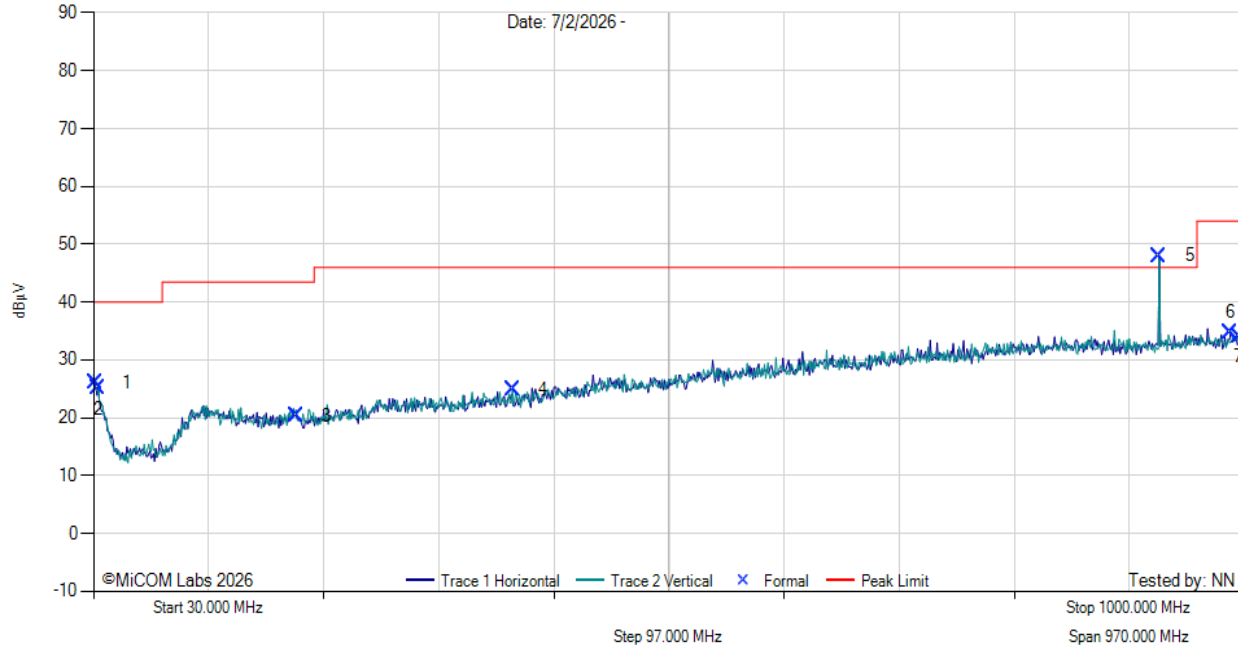
[back to matrix](#)



30.00 - 1000.00 MHz												
Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB/m	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail
1	30.97	27.25	3.97	-4.56	26.66	MaxP	Horizontal	99	120	40.0	-13.3	Pass
2	32.91	26.87	4.05	-6.19	24.73	MaxP	Vertical	149	179	40.0	-15.3	Pass
3	196.84	30.56	4.76	-13.26	22.06	MaxP	Horizontal	199	120	43.5	-21.4	Pass
4	481.05	30.29	5.81	-7.59	28.51	MaxP	Vertical	99	240	46.0	-17.5	Pass
5	949.56	28.94	7.57	-1.95	34.56	MaxP	Vertical	149	0	46.0	-11.4	Pass
6	978.66	28.96	7.64	-1.68	34.92	MaxP	Horizontal	149	240	54.0	-19.1	Pass

Test Notes: 50kbps, 25khz deviation, 2-GFSK, 14dBm

[back to matrix](#)



30.00 - 1000.00 MHz												
Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB/m	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail
1	31.94	27.36	4.04	-5.34	26.05	MaxP	Vertical	100	29	40.0	-13.9	Pass
2	33.88	28.04	4.05	-6.90	25.18	MaxP	Horizontal	149	300	40.0	-14.8	Pass
3	200.72	28.48	4.77	-12.96	20.28	MaxP	Horizontal	100	270	43.5	-23.2	Pass
4	383.08	29.67	5.46	-10.23	24.89	MaxP	Vertical	199	0	46.0	-21.1	Pass
5	928.22	42.53	7.51	-2.06	47.98	Fundamental	Horizontal	100	330	--	--	Pass
6	988.36	28.68	7.57	-1.50	34.75	MaxP	Horizontal	199	240	54.0	-19.3	Pass
7	995.15	27.96	7.57	-1.44	34.08	MaxP	Vertical	149	239	54.0	-19.9	Pass

Test Notes: 50kbps, 25khz deviation, 2-GFSK, 14dBm

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1GHz – 18 GHz



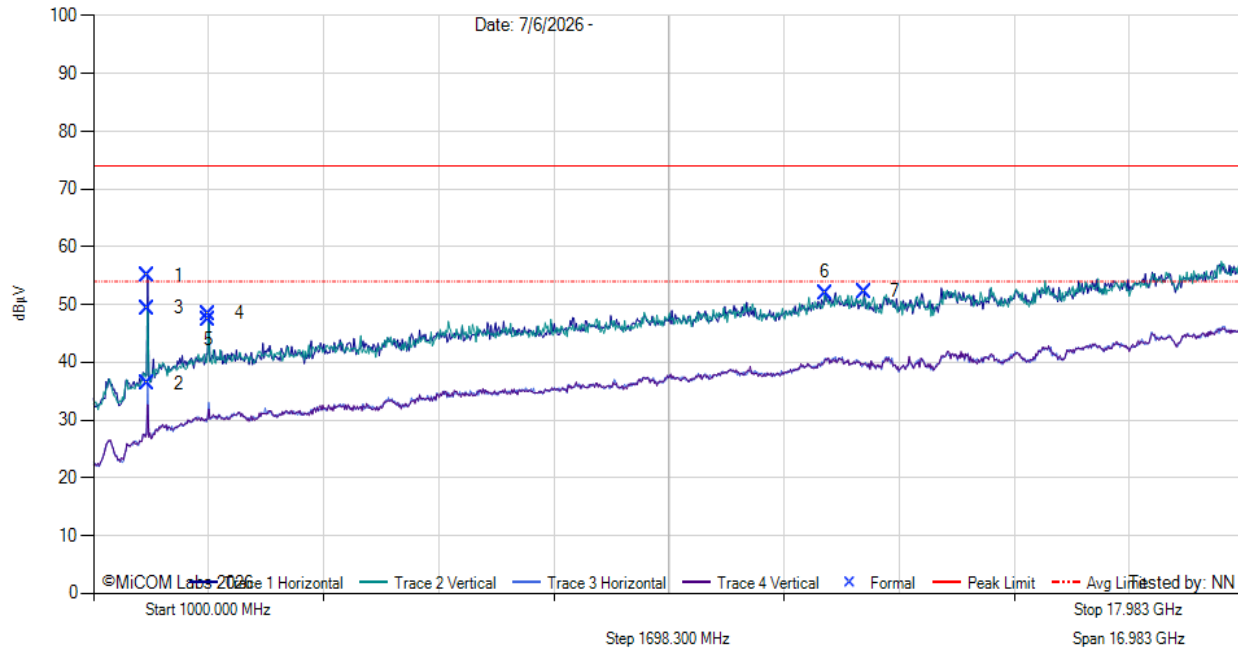
FCC Spurious 1 GHz -18 GHz

Test Freq: 902.2 MHz, Antenna: Integral Ignion (NN02-224)

Measurement Distance: 3m

Sweep Time: 100 ms

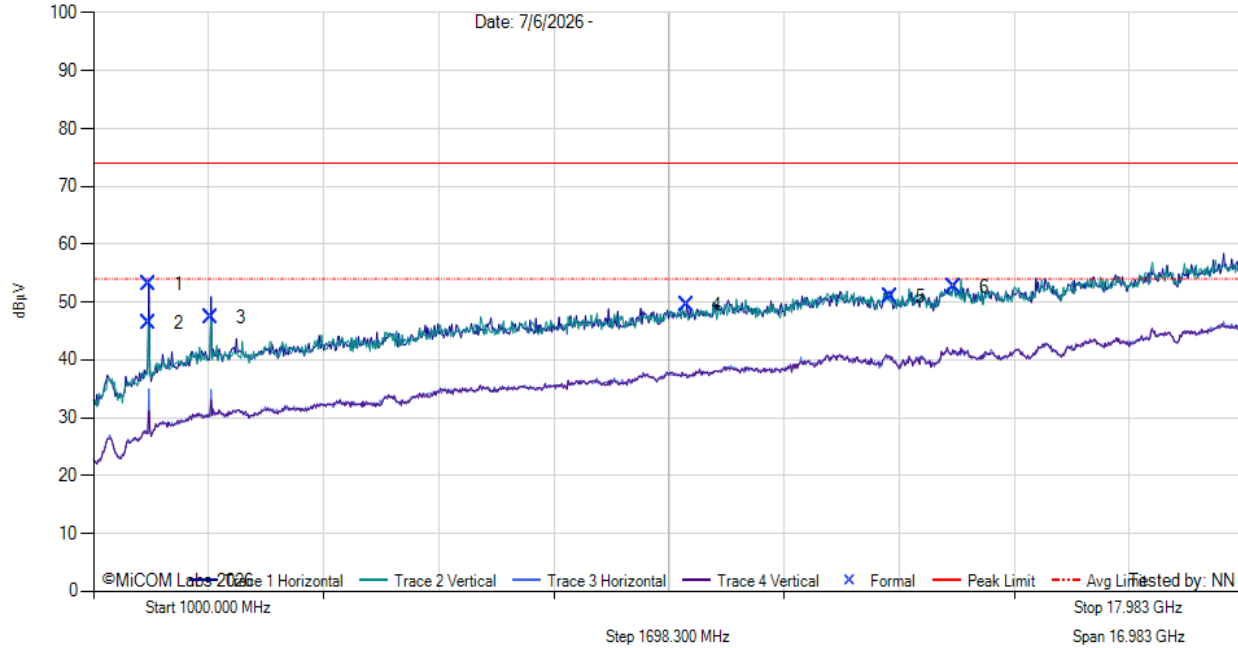
RBW: 1 MHz
VBW: 3 MHz



1000.00 - 18000.00 MHz												
Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB/m	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail
1	1799.00	66.67	2.97	-14.67	54.97	MaxP	Horizontal	149	240	74.0	-19.0	Pass
2	1799.00	48.06	2.97	-14.67	36.36	AVG	Horizontal	149	240	54.0	-17.6	Pass
3	1799.00	61.05	2.97	-14.67	49.35	MaxP	Vertical	199	330	74.0	-24.6	Pass
4	2700.00	56.47	3.69	-11.74	48.42	MaxP	Horizontal	199	0	74.0	-25.6	Pass
5	2700.00	55.53	3.69	-11.74	47.47	MaxP	Vertical	199	330	74.0	-26.5	Pass
6	11795.00	48.37	9.40	-5.72	52.06	MaxP	Vertical	149	149	74.0	-21.9	Pass
7	12373.00	49.21	9.22	-6.15	52.28	MaxP	Horizontal	149	60	74.0	-21.7	Pass

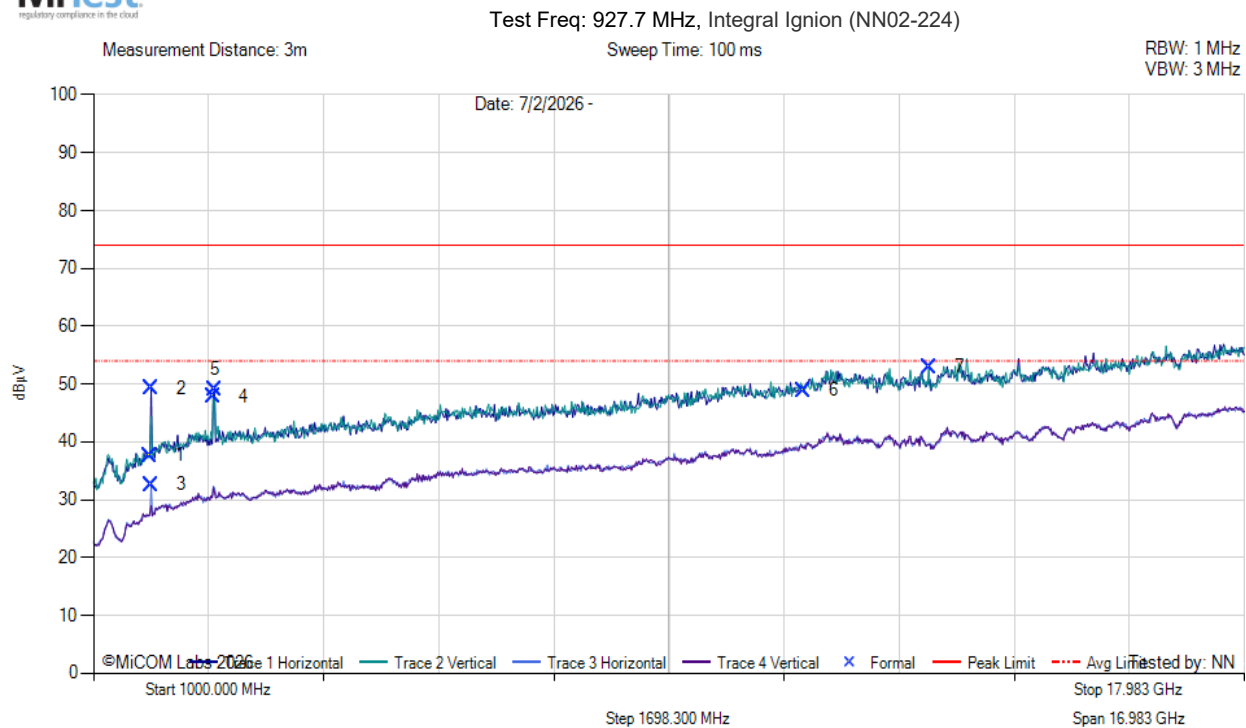
Test Notes: 50kbps, 25khz deviation, 2-GFSK, 14dBm

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1000.00 - 18000.00 MHz												
Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB/m	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail
1	1816.00	64.65	2.98	-14.49	53.14	MaxP	Horizontal	149	300	74.0	-20.9	Pass
2	1816.00	57.97	2.98	-14.49	46.46	MaxP	Vertical	149	330	74.0	-27.5	Pass
3	2734.00	55.74	3.21	-11.55	47.40	MaxP	Vertical	149	330	74.0	-26.6	Pass
4	9755.00	48.30	7.26	-6.11	49.45	MaxP	Horizontal	199	150	74.0	-24.6	Pass
5	12764.00	49.96	9.14	-8.12	50.98	MaxP	Horizontal	199	90	74.0	-23.0	Pass
6	13699.00	49.81	9.55	-6.78	52.58	MaxP	Vertical	149	59	74.0	-21.4	Pass
Test Notes: 50kbps, 25khz deviation, 2-GFSK, 14dBm												

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1000.00 - 18000.00 MHz												
Num	Frequency MHz	Raw dBµV	Cable Loss dB	AF dB/m	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
1	1833.00	49.13	3.00	-14.45	37.69	MaxP	Vertical	149	209	74.0	-36.3	Pass
2	1850.00	60.69	3.02	-14.40	49.31	MaxP	Horizontal	149	60	74.0	-24.7	Pass
3	1850.00	43.96	3.02	-14.40	32.58	AVG	Horizontal	149	60	54.0	-21.4	Pass
4	2768.00	56.08	3.22	-11.47	47.83	MaxP	Vertical	149	330	74.0	-26.2	Pass
5	2785.00	56.78	3.76	-11.53	49.01	MaxP	Horizontal	199	0	74.0	-25.0	Pass
6	11472.00	45.32	9.01	-5.47	48.86	MaxP	Horizontal	149	330	74.0	-25.1	Pass
7	13325.00	51.61	9.40	-8.04	52.98	MaxP	Vertical	149	209	74.0	-21.0	Pass

Test Notes: 50kbps, 25khz deviation, 2-GFSK, 14dBm

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A.4.2.3.1 External Antenna / AVX Kyocera (X9000984-4GDSMB)

30MHz – 1GHz



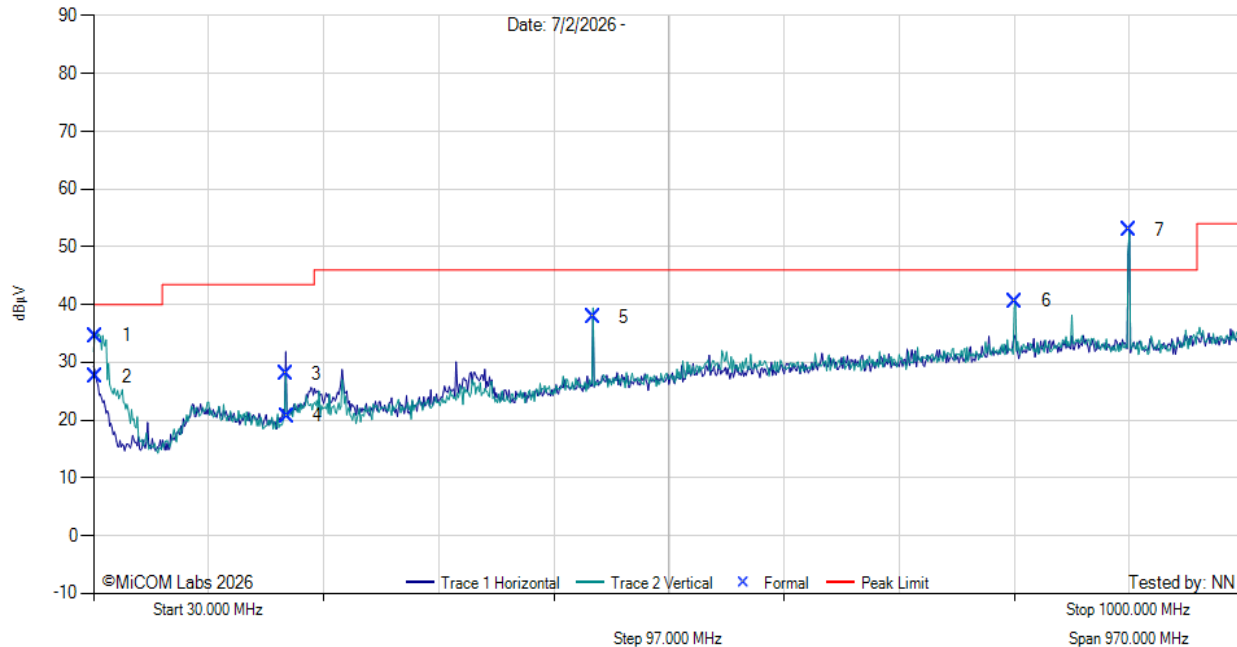
30 MHz to 1 GHz

Test Freq: 902.2 MHz, Antenna: External / AVX Kyocera (X9000984-4GDSMB)

Measurement Distance: 3m

Sweep Time: 170 ms

RBW: 120 KHz
VBW: 300 KHz



30.00 - 1000.00 MHz												
Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB/m	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail
1	31.94	35.94	4.04	-5.34	34.64	MaxP	Vertical	100	149	40.0	-5.4	Pass
2	31.94	28.82	4.04	-5.34	27.51	MaxP	Horizontal	199	270	40.0	-12.5	Pass
3	191.99	37.41	4.75	-14.11	28.05	MaxP	Vertical	149	330	43.5	-15.5	Pass
4	192.96	30.00	4.75	-14.01	20.73	MaxP	Horizontal	199	90	43.5	-22.8	Pass
5	450.98	40.53	5.68	-8.40	37.82	MaxP	Horizontal	199	30	46.0	-8.2	Pass
6	806.97	37.11	7.06	-3.56	40.61	MaxP	Vertical	149	209	46.0	-5.4	Pass
7	903.00	47.96	7.42	-2.45	52.92	Fundamental	Vertical	199	119	--	--	Pass

Test Notes: External Ant, 14dBm, 50KBps, 25KHz Deviation, 2-GFSK.

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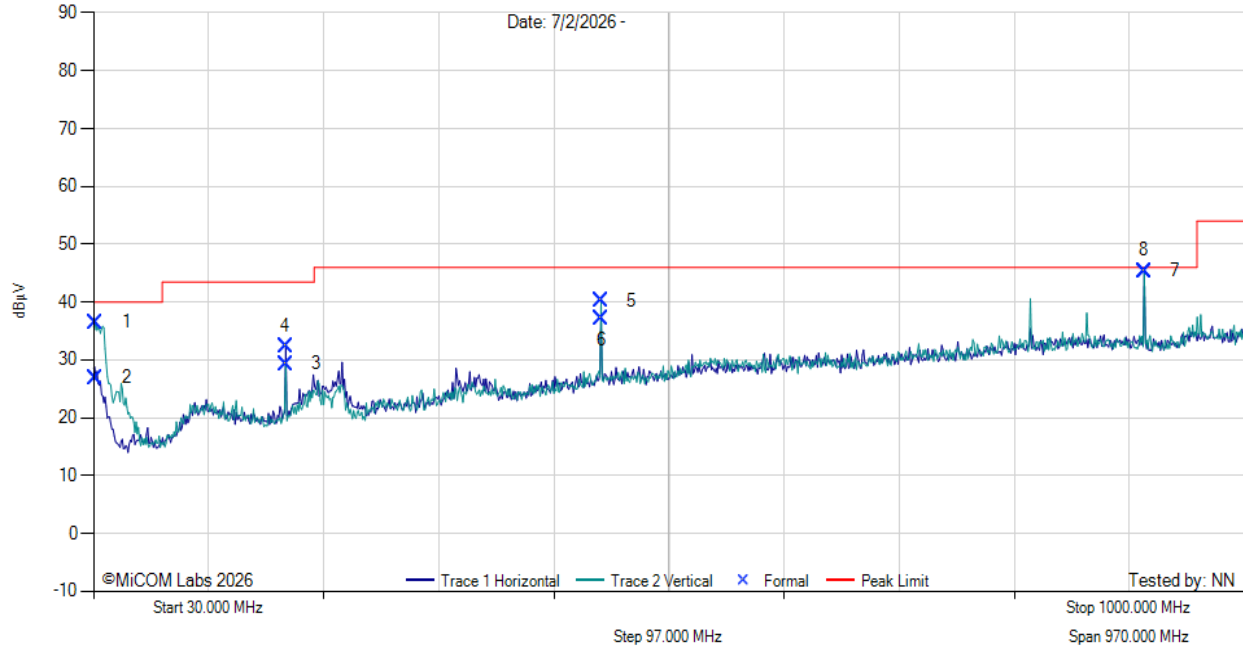
30 MHz to 1 GHz

Test Freq: 915 MHz, Antenna: External / AVX Kyocera (X9000984-4GDSMB)

Measurement Distance: 3m

Sweep Time: 170 ms

RBW: 120 KHz
VBW: 300 KHz



30.00 - 1000.00 MHz												
Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB/m	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail
1	31.94	37.83	4.04	-5.34	36.52	MaxP	Vertical	99	149	40.0	-3.5	Pass
2	31.94	28.25	4.04	-5.34	26.95	MaxP	Horizontal	199	149	40.0	-13.1	Pass
3	191.99	38.65	4.75	-14.11	29.29	MaxP	Vertical	149	330	43.5	-14.2	Pass
4	191.99	41.72	4.75	-14.11	32.36	MaxP	Horizontal	99	149	43.5	-11.1	Pass
5	457.77	42.66	5.74	-8.13	40.28	MaxP	Vertical	99	209	46.0	-5.7	Pass
6	457.77	39.49	5.74	-8.13	37.10	MaxP	Horizontal	199	240	46.0	-8.9	Pass
7	915.61	40.23	7.46	-2.30	45.39	Fundamental	Vertical	99	330	--	--	--
8	915.61	40.22	7.46	-2.30	45.38	Fundamental	Horizontal	199	330	--	--	--

Test Notes: External Ant, 14dBm, 50KBps, 25KHz Deviation, 2-GFSK.

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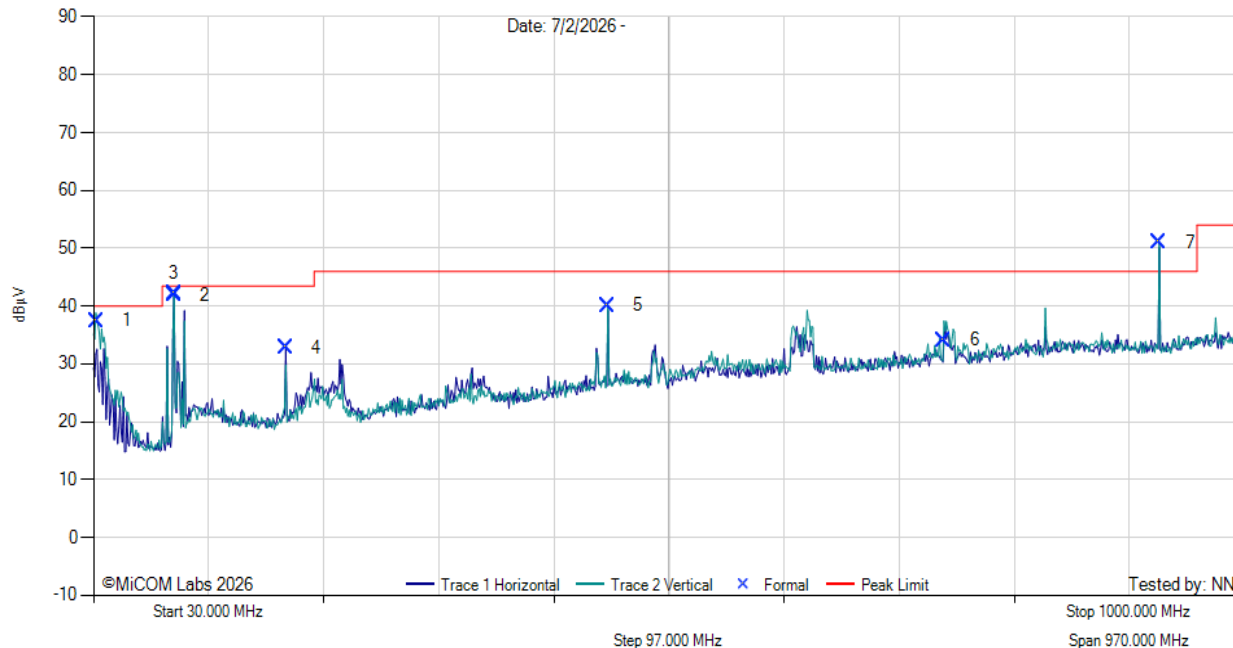
30 MHz to 1 GHz

Test Freq: 927.7 MHz, Antenna: External / AVX Kyocera (X9000984-4GDSMB)

Measurement Distance: 3m

Sweep Time: 170 ms

RBW: 120 KHz
VBW: 300 KHz



30.00 - 1000.00 MHz												
Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB/m	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail
1	32.91	39.61	4.05	-6.19	37.47	MaxP	Vertical	100	149	40.0	-2.5	Pass
2	97.90	53.88	4.32	-16.36	41.84	MaxP	Vertical	149	330	43.5	-1.7	Pass
3	97.90	54.14	4.32	-16.36	42.10	MaxP	Horizontal	149	180	43.5	-1.4	Pass
4	191.99	42.19	4.75	-14.11	32.83	MaxP	Horizontal	100	120	43.5	-10.7	Pass
5	463.59	42.27	5.75	-7.91	40.11	MaxP	Vertical	100	179	46.0	-5.9	Pass
6	746.83	31.38	6.86	-4.14	34.10	MaxP	Horizontal	100	210	46.0	-11.9	Pass
7	928.22	45.51	7.51	-2.06	50.96	Fundamental	Vertical	149	29	--	--	Pass

Test Notes: External Ant, 14dBm, 50KBps, 25KHz Deviation, 2-GFSK.

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1GHz – 18 GHz



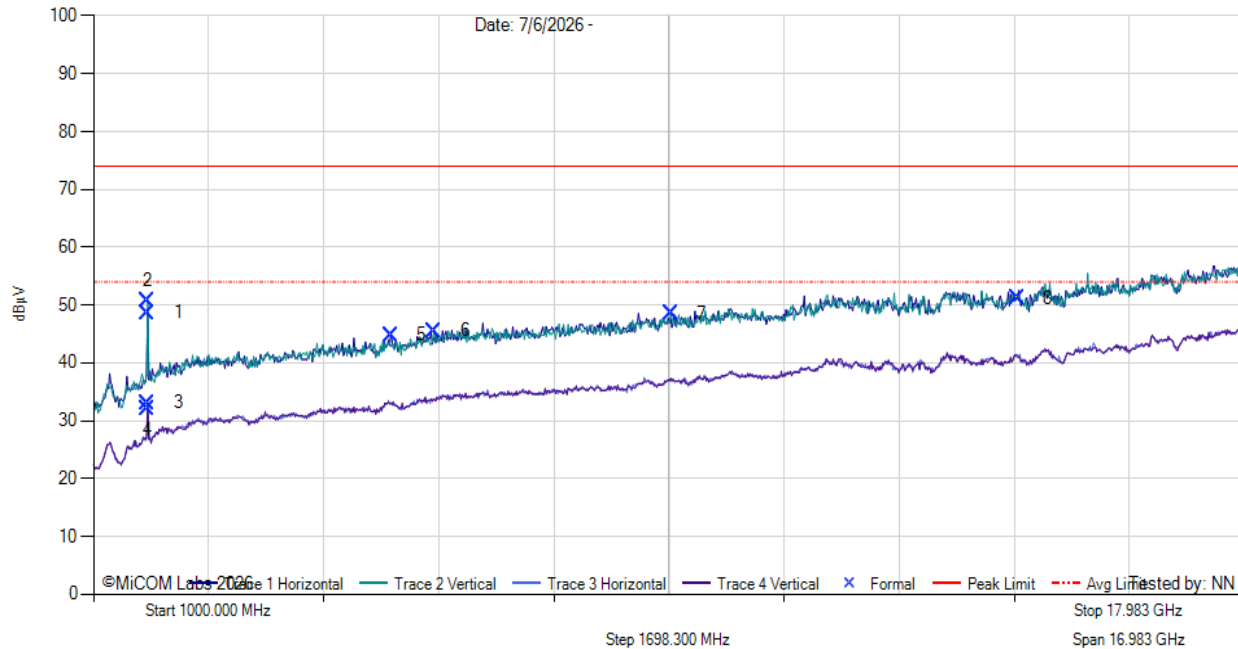
FCC Spurious 1 GHz -18 GHz

Test Freq: 902.2MHz, Antenna: External / AVX Kyocera (X9000984-4GDSMB)

Measurement Distance: 3m

Sweep Time: 100 ms

RBW: 1 MHz
VBW: 3 MHz



1000.00 - 18000.00 MHz												
Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB/m	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail
1	1799.00	60.34	2.97	-14.67	48.64	MaxP	Horizontal	150	300	74.0	-25.4	Pass
2	1799.00	62.33	2.97	-14.67	50.63	MaxP	Vertical	150	0	74.0	-23.4	Pass
3	1799.00	44.78	2.97	-14.67	33.08	AVG	Vertical	150	29	54.0	-20.9	Pass
4	1799.00	43.67	2.97	-14.67	31.97	AVG	Horizontal	150	300	54.0	-22.0	Pass
5	5386.00	50.61	5.50	-11.30	44.81	MaxP	Horizontal	199	0	74.0	-29.2	Pass
6	6032.00	49.21	6.03	-9.67	45.57	MaxP	Vertical	150	239	74.0	-28.4	Pass
7	9517.00	47.59	7.21	-6.19	48.61	MaxP	Vertical	199	330	74.0	-25.4	Pass
8	14634.00	47.38	9.23	-5.39	51.23	MaxP	Horizontal	199	330	74.0	-22.8	Pass

Test Notes: 50kbps, 25khz deviation, 2-GFSK, 14dBm

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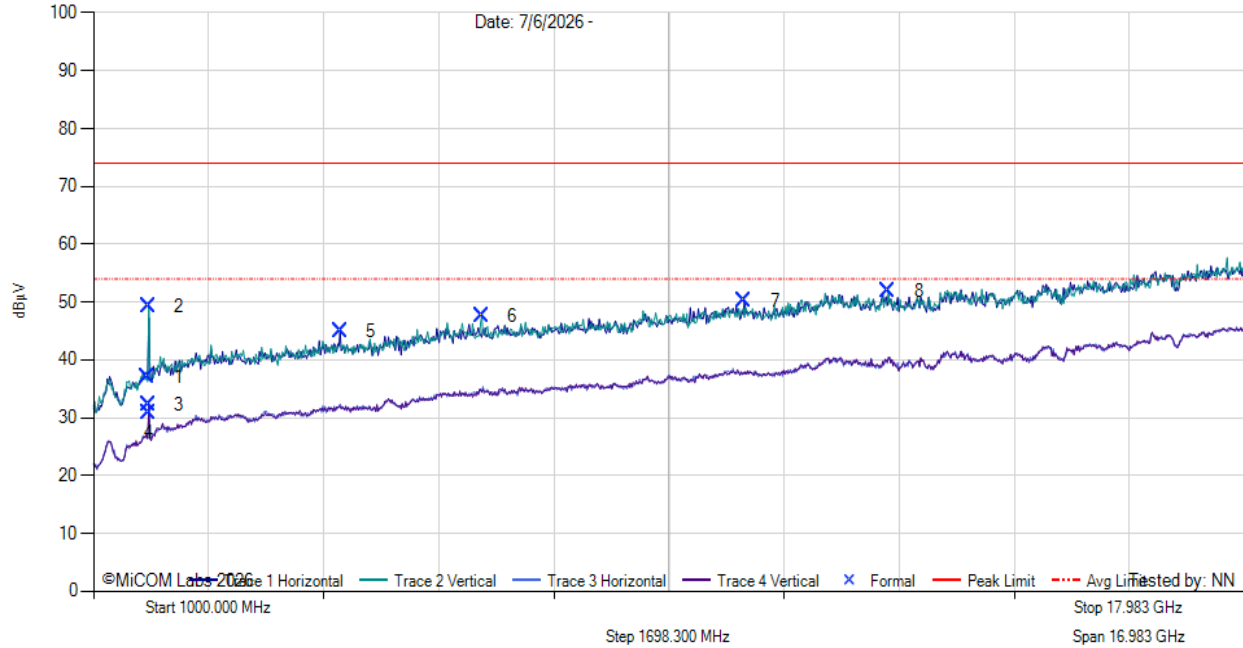
FCC Spurious 1 GHz -18 GHz

Test Freq: 915 MHz, Antenna: External / AVX Kyocera (X9000984-4GDSMB)

Measurement Distance: 3m

Sweep Time: 100 ms

RBW: 1 MHz
VBW: 3 MHz



1000.00 - 18000.00 MHz												
Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB/m	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail
1	1799.00	48.74	2.97	-14.67	37.04	MaxP	Horizontal	149	30	74.0	-37.0	Pass
2	1816.00	60.84	2.98	-14.49	49.33	MaxP	Vertical	149	0	74.0	-24.7	Pass
3	1816.00	43.70	2.98	-14.49	32.19	AVG	Vertical	150	0	54.0	-21.8	Pass
4	1816.00	42.44	2.98	-14.49	30.93	AVG	Horizontal	149	240	54.0	-23.1	Pass
5	4638.00	51.98	4.98	-12.01	44.95	MaxP	Horizontal	199	300	74.0	-29.1	Pass
6	6729.00	49.09	6.25	-7.74	47.60	MaxP	Vertical	199	299	74.0	-26.4	Pass
7	10605.00	46.83	8.11	-4.72	50.22	MaxP	Horizontal	199	60	74.0	-23.8	Pass
8	12730.00	50.55	9.15	-7.74	51.96	MaxP	Vertical	199	0	74.0	-22.0	Pass

Test Notes: 50kbps, 25khz deviation, 2-GFSK, 14dBm

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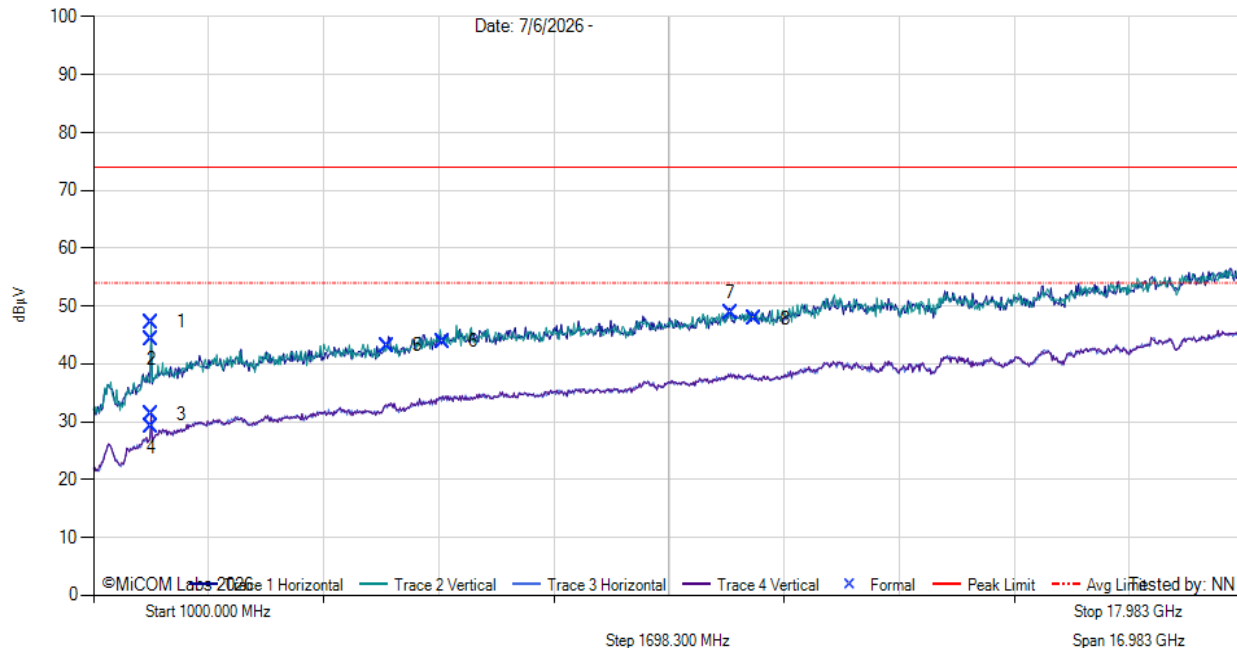
FCC Spurious 1 GHz -18 GHz

Test Freq: 927.7 MHz, Antenna: External / AVX Kyocera (X9000984-4GDSMB)

Measurement Distance: 3m

Sweep Time: 100 ms

RBW: 1 MHz
VBW: 3 MHz



1000.00 - 18000.00 MHz												
Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB/m	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail
1	1850.00	58.58	3.02	-14.40	47.20	MaxP	Vertical	199	179	74.0	-26.8	Pass
2	1850.00	55.74	3.02	-14.40	44.36	MaxP	Horizontal	150	240	74.0	-29.6	Pass
3	1850.00	42.69	3.02	-14.40	31.30	AVG	Vertical	150	89	54.0	-22.7	Pass
4	1850.00	40.46	3.02	-14.40	29.07	AVG	Horizontal	150	240	54.0	-24.9	Pass
5	5335.00	49.08	5.44	-11.41	43.12	MaxP	Horizontal	199	330	74.0	-30.9	Pass
6	6151.00	46.83	6.14	-9.11	43.87	MaxP	Vertical	150	119	74.0	-30.1	Pass
7	10401.00	45.72	7.79	-4.76	48.76	MaxP	Horizontal	199	30	74.0	-25.2	Pass
8	10758.00	45.35	8.20	-5.69	47.86	MaxP	Vertical	199	0	74.0	-26.1	Pass

Test Notes: 50kbps, 25khz deviation, 2-GFSK, 14dBm

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